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Eau Claire. City of Wisconsin, U.S.A., the co. seat of Eau Claire co. At the confluence of the Eau Claire and Chippewa rivers, 88 m. E. of St. Paul, it is served by several rlys. Its buildings include a Carnegie library and state teachers' college. The commercial centre of N.W. Wisconsin, outlet for the Chippewa lumber district, Eau Claire makes machinery, refrigerators, aluminium products, tires, and harness. Settled in 1846, it was granted a city charter in 1872. Pop. (1950) 36,058.

Eau-de-Cologne. A perfume said to have been invented by an Italian chemist, Johann Maria Farina, who settled in Cologne in 1709. It is believed that the original recipe was lost and never recovered, though many chemists in Cologne, using the name Farina, claim to be the sole owners of it. The perfume is prepared from alcoholic vegetable extracts, essential oils, and rectified spirits. The usual recipe prescribes twelve drops of each of the essential oils, bergamot, citron, neroli, orange, and rosemary, with one dram of Malabar cardamoms and a gallon of rectified spirits, which are distilled together. Eau-de-Cologne is made in Great Britain by mixing the essential oils with a highly purified spirit so that distillation is unnecessary.

Eau-de-Javel. Bleaching liquid first made in 1789 at the Javel chemical works, Paris. Prepared by passing chlorine gas into a solution of potash, it was the first practical means of utilising the bleaching properties of chlorine, and was also used as a disinfectant. Some little time later Charles Tennant, of Glasgow, prepared bleaching powder by passing chlorine gas over quicklime, and Labarraque, a French chemist, made a better bleaching liquid, eau-de-Labarraque, which is a solution of sodium hypochlorite made from sodium carbonate and calcium hypochlorite.

Eau-de-vie (Fr., water of life). Old French name for brandy. The product of a distilled wine was so called in the 13th and 14th centuries, and the name is still used. The eaux-de-vie de marc are distilled from wine lees or from the residue in the stills after the best brandy has been made. See Brandy; Fire-Water.

Eaux-Bonnes. Spa and winter sports centre of France. In the dept. of Basses-Pyrénées, it is 28 m. S. of Pau. It stands 2,460 ft. high, just where two streams, coming down from the Pyrenees—the

Sourde and the Valentin—meet, and is named on account of its waters which have been known since the 14th century, and are used in the treatment of lung and other troubles. Pop. (1954) 558.

Five miles to the S.W. is Eaux-Chaudes, standing where a stream, the Gave d'Ossan, comes down from the Pyrenees through a valley that is among the most beautiful in the neighbourhood. Here also are hot springs which are sulphurous and are used in treating rheumatism, respiratory affections, and other disorders.

Ebb. Reflux or return of the tide-water towards the sea. Ebb tide occurs when tidal water returns to the lowest point it can reach on any particular day.

Ebbsfleet. Coast hamlet of the Isle of Thanet, Kent, England. It stands on Pegwell Bay, 3½ m. S.W. of Ramsgate, and is the traditional landing point of Hengist and Horsa in 449-450, and also the place at which St. Augustine and his forty monks disembarked in 597 to undertake the re-evangelisation of the English.

Ebbw Vale. An urban district of Monmouthshire, England. It stands on the Ebbwfawr, a head-stream of the Ebbw, 21 m. N.W. of Newport, and is served by two railways. In a busy colliery district, it has large tinplate works, iron and steel being also manufactured on a large scale. Christ Church is a modern building in the E.E. style. Market day, Sat. Pop. (1951) 29,220.

Ebbw Vale gives its name to a county constituency. Aneurin Bevan, who was born at Tredegar near by and worked as a miner in the area, was Labour M.P. for Ebbw Vale from 1929. *Pron.* ebbo.

Ebenaceae. Family of trees and shrubs: the ebony family. They have alternate, undivided leaves and regular flowers, succeeded by berries. They are chiefly natives of tropical countries. The timber is hard and dark-coloured. See Ebony.

Eben-Emael. A fortress of Liège, Belgium. When the Ger-

mans invaded Belgium on May 10, 1940, the fortress system of Liège was one of the main bastions of the defence. Eben-Emael, the most recent of the fortifications, covered 200 acres. Tremendous attacks were developed by German heavy artillery, bombing planes, and waves of infantry. Parachutists landed on the top of the fort in darkness, and put the defensive armament out of action by thrusting bombs and explosives through the casemates. The remaining forts in the Liège system held out for some days, but the Germans claimed the capture of all the inner works by May 21. (See illus. p. 1059.)

In the course of the liberation of Belgium, Eben-Emael was captured by the Allies Sept. 12, 1944.

Ebenezer (Heb., stone of help). Name of an unidentified spot where the Hebrews were defeated by the Philistines (1 Sam. 7); also that of a stone set up by Samuel near Mizpah in memory of an Israelitish victory over the Philistines (1 Sam. 4). It is used as a Christian name.

Eberhard (1445-96). Duke of Württemberg. Born Dec. 11, 1445, a member of the ruling family of Württemberg, the fifth to bear the name Eberhard, he became count of one part of it in 1457. In 1482 he secured the rest of the country, and in 1495 was raised to the rank of a sovereign duke. By uniting Württemberg and by obtaining support for certain changes, both from the emperor without and from his own nobles within, he is regarded as the founder of the country. One who shared in the intellectual awakening of his time, he founded the University of Tübingen and encouraged scholars. Eberhard, who was known as the Bearded (im Bart), died Feb. 25, 1496, at Tübingen.

Ebers, GEORG MORITZ (1837-98). German Egyptologist and novelist. Born March 1, 1837, at Berlin, he studied at Göttingen and Berlin, and early specialised in Egyptology. To popularise his favourite study through the medium of fiction, he published a novel in 1864 (Eng. trans. *An Egyptian Princess*, 1870-71). In 1865 he became lecturer and later professor in Egyptology at Jena; he held a similar post at Leipzig 1870-89.

After travels in Egypt, Ebers published a work on Egypt and the Book of Moses, 1868. He revisited Egypt in 1872-73 and found at Thebes the so-called Papyrus Ebers (later acquired by Leipzig

Museum). The longest and most important of Egyptian medical papyri, in it magic and medicine are interwoven; it was written in the early XVIIIth dynasty and seems to be a compilation of prescriptions and excerpts from earlier medical textbooks.

Ebers also wrote historical novels descriptive of South Germany and the Netherlands in the 16th century. He died at Tutzing, Aug. 7, 1898.

Ebert, FRIEDRICH (1871-1925). German president. Born at Heidelberg, Feb. 4, 1871, and educated at an elementary school, he was apprenticed to a saddler of that town. In 1892 he became editor of the Socialist organ, Bremer Bürgerzeitung, and in 1894 married Louise Kamp, who, he said, proved his best counsellor throughout his career. Leader of the Socialists by 1916, in the revolution of 1918 he succeeded Prince Max of Baden as chancellor on Nov. 9, and then became provisional president of Germany. The first Socialist president maintained his position through the stormy days of Jan., 1919, and at the opening of the new national assembly at Weimar on Feb. 6, made a long protest against the armistice terms, and urged the union of German Austria with Germany. On Feb. 11 Ebert was confirmed in the presidency of the republic which he held until his death on Feb. 28, 1925. His rule was tactful and statesmanlike and he was held in respect by the German states. He published several books, including a study of German Social Democracy, 1924.

Eberth, KARL JOSEPH (1835-1926). German bacteriologist. Born in Würzburg, Sept. 21, 1835, he studied under Kolliker and Virchow. He was professor at Zürich, 1874, and at Halle, 1881-1911. He made important contributions to bacteriology, and in 1880 discovered the typhus bacillus which bears his name. He died Dec. 2, 1926.

Ebionites (Hebr. *ebyōn*, poor). Name given to certain Judaizing sects in the Christian Church in the 2nd century. Denying the divinity of Christ, they regarded Christianity as merely a reformed type of the Jewish religion, and Christ as only a natural man of exceptional spiritual attainments acquired by a strict observance of the law of Moses. References in the writings of Irenaeus and other Fathers state that the Ebionites observed all the details of the Mosaic Law, recognized only the

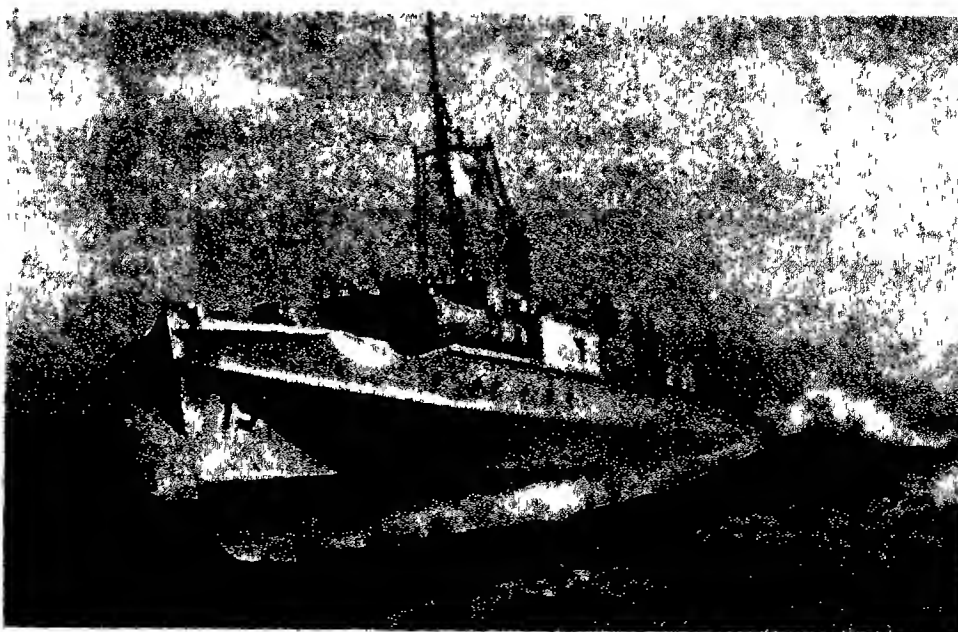
Gospel of S. Matthew, and rejected S. Paul as an apostate. At a later period many of the Ebionites held the Gnostic heresy of the dualistic origin of the universe.

Eblis or **IBLIS**. A Mahomedan name for Satan or the prince of darkness. In the Koran it is stated that God, having made Adam, called upon the angels to bow down and worship him; all did so except Eblis, who refused, and became the declared enemy of the newly created race of men. Eblis is also described as chief of the genii.

E-Boat. Popular but incorrect name given to the *Schnellboot* (Ger. swift boat), or motor torpedo-boat used by the Germans in the Second Great War. The name was incorrectly applied under the impression that the German term was *Kilboot* (speedboat); whereas the official title was *Schnellboot* and the letter S was prefixed to a vessel's number. The largest type displaced 86 tons on a length of 105 ft. and was driven by Diesel engines developing 2,400 h.p. to give a speed of 33 knots.

There were two 19.7-in. torpedo-tubes mounted on either beam and firing forward. With a crew of 19, the vessel had a range of 600 m.

Schnellboote were the most active of the German surface craft during the war, frequently attacking Allied convoys in the English Channel and the Mediterranean. Lying low in the water, they were inconspicuous and could launch their torpedoes before their targets detected their presence. They made extensive use of smoke both before and after attack. Their activities were eventually checked by sweeps organized by the R.A.F. and by motor torpedo boats. See Coastal Forces Craft.



E-Boat. German motor torpedo-boat of the Second Great War, here seen at high speed

Ebonite or **VULCANITE**. Hard vulcanised rubber made by mixing pure rubber with about one-third of its weight of sulphur, and heating for a number of hours in temperature rising to 300° F. Ebonite is often used as a substitute for bone, ivory, and horn, for making small ornamental articles like combs, knife handles, buttons, etc. It can be moulded, cut, carved, and polished to a high degree of perfection. It has good electrical insulation properties, though for high frequency work plastics have been found more satisfactory. See Rubber.

Ebony (*Diospyros*). Trees of the family Ebenaceae, whose heart-wood is the ebony of commerce. Several species furnish the timber, the difference being denoted by the place of origin. Mauritius ebony is the produce of *D. ebenum*; this, with that produced by *D. reticulata*, is the finest known. Coromandel ebony comes from *D. melanoxylon*. Calamander wood, a variegated ebony, is the timber of *D. guaculta* from India and Ceylon. Some species have edible fruits. See Date-plum; Persimmon.

Ebor. Abbreviation of Eboracum or Eburacum (*q.v.*), the Latin name for York. It is used as a signature by the archbishops of York.

Eboracum. See Eburacum.

Eboué, ADOLPHE FÉLIX SYLVESTRE (1884-1944). French administrator. Eboué, the son of an African negro, was born in Cayenne, French Guiana, and educated at Cayenne College and the Sorbonne, Paris. He entered the French colonial service and in 1936 became governor of Guadeloupe, the first man of colour to rise to that position. Governor of Lake Chad Territory from

1938, he refused to capitulate at the order of Vichy and declared for de Gaulle, Aug., 1940, thereby securing for the Allies the whole of Central Africa from W. to E. He became governor-general of French Equatorial Africa in Nov., 1940, and died in Cairo, May 17, 1944, while on his way to the Lebanon.



Ebony. Fruit and leaf of Persimmon, an ebony tree

Ebro (anc. *Ibērus*). River of N.E. Spain. Rising in the Cantabrian Mts., in the prov. of Santander, it flows S.E. to the Mediterranean. Its length is about 460 m., and it drains some 35,000 sq. m. Its chief affluents are the Jalon, Huerva, Guadaloque, Aragon, Gallego, and Segre. Running through narrow valleys, its channel is obstructed by shoals and rapids. Ships can proceed only as far as Tortosa (16 m.).

During the Spanish Civil War, 1936-39, there was heavy fighting along the line of the Ebro when government forces launched an offensive across the river in July, 1938, to relieve pressure on the Sagunto sector. Gen. Franco's troops were taken by surprise, and the Ebro was crossed on July 25. Gandesa was almost enveloped, despite frequent and costly counter-attacks. On Aug. 7 Franco began a counter-offensive and made some progress; but during the ensuing three weeks neither side gained any real advantage. Some 300,000 men were engaged in a sixth attack on Oct. 2, but, despite great superiority in the air, Franco's troops achieved only local gains, and by the end of the month the government forces were still inside his territory. On Nov. 7 the Nationalists seized the bridgehead of Mora de Ebro; by the middle of that month the government forces had been cleared from the left bank of the river, which was recrossed on the 16th. The Ebro battles laid the foundations for Franco's conquest of Catalonia; the losses incurred by the government army, estimated at 40,000, could not be replaced and undermined morale. The Nationalists employed massed artillery and extensive bombing in this campaign, while the government relied on intricate field fortifications.

Ebullioscope. Apparatus for determining the boiling-point of a liquid, *e.g.* in working out molecular weights. It is sometimes employed for ascertaining the alcoholic strength of solutions from the temperatures at which they boil.

Eburacum or **EBORACUM**. Roman town on the site of which the city of York, England, now stands. Here Hadrian held court, A.D. 120; Severus, 211, and Constantius Chlorus, 306, died; and Constantine the Great was proclaimed emperor, 306. The name, of Celtic origin, implies a pre-existing settlement. The legionary fortress, erected c. A.D. 71-74, was the base

for the conquest and control of N. Britain. The accompanying civil settlement was given colonial rank in the 2nd century.

Eça de Queiroz, JOSÉ MARIA (1845-1900). Portuguese author. Born at Povoá do Varzim, near



J. M. Eça de Queiroz,
Portuguese author

Oporto, Nov. 25, 1843, and educated at Coimbra university, he joined in 1871 the staff of the critical journal *As Farpas*. In 1874 he published a novel which attracted a good deal of attention, *O Crime do Padre Amaro*. He was Portuguese consul successively at Havana, Newcastle, Bristol, and Paris. His later stories included *O Primo Bazilio*, 1877 (Eng. trans. *Dragon's Teeth*, 1889) and *A Reliquia*, 1886. The posthumous collection of *Contos*, 1902, contained the famous stories *O Defunto* and *O Suave Milagre*, translated into English as *Our Lady of the Pillar* and *The Sweet Miracle*. He died Aug. 16, 1900.

Écarté (Fr., discarded). A card game for two players which had a great vogue in France at the beginning of the 19th century. The six down to the two inclusive of each suit having been removed from the pack, the players cut for deal, and the pack is shuffled by the dealer, and cut by his opponent. The dealer then gives five cards to the other player and to himself: either three and two or two and three alternately. The eleventh card is turned up for trumps, the remainder of the pack forming the stock. Should the eleventh card be a king the dealer scores one point; otherwise the turn-up has no scoring value.

The players then look at their hands, and should the non-dealer (the leader) be satisfied with his cards, he may at once proceed to play them. But if he considers it would be advantageous to change any or all of them, he says, "I propose" or "Cards." The dealer then has the option of changing his cards also; and on deciding to do so says, "I accept" or "How many?" Should he be satisfied with his cards, he may refuse, and exclaim "I refuse" or "Play." If either player refuse to change cards, then both must play their original hands. Otherwise, the discarding of cards for others in the stock may proceed so long as both are agreeable. The players

being satisfied with their hands, the play begins. If either holds the king of trumps he must declare it before playing his first card, and is entitled to mark one point.

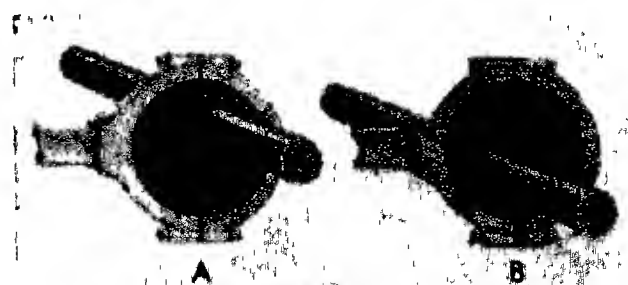
The object of the game is to make tricks; the highest card of a suit wins, though a trump naturally scores over any card of another suit. A player must always take a trick if able to do so. The cards rank in this order: King, queen, knave, ace, ten, down to seven. The winner of a trick always leads to the next. The score is made as follows: Turning up or holding the king of trumps counts 1; winning three tricks out of five is called the *point* and also counts 1; winning all five tricks is termed the *vole* and counts 2. If either player fail to make three tricks after having declined cards, his adversary scores 2. A game consists of 5 points.

Ecbatana, **AGBATANAS**, OR **HANGMATANA** (Heb. Achmetha, Ezra 6). Ancient capital of Media. Here Cyrus was crowned in 549 after his defeat of Astyages. Nearly 6,000 ft. above sea level, it became a residence of Persian and Parthian kings. The modern Hamadan lies over the ancient mound. Herodotus describes the sevenfold fortifications, each a different colour (I, 98).

Ecbatana in Syria, where Cambyses died, may have been Hamath.

Ecce Homo (Lat., Behold the Man). Short title of a survey of the life and work of Jesus Christ by Sir J. R. Secley. It was published anonymously in 1866, and caused a storm of criticism. It attempted to present Christ as an exclusively human personality, the founder of a new system of society.

Eccentric (Gr. *ekkentros*, out of the centre). In engineering, a metal disk, mounted eccentrically on a shaft, to give reciprocating movement to a valve or pump or lever. The edge of the eccentric is grooved and encircled by an eccentric strap, one half of which is secured rigidly to the front end of a connecting-rod. In effect an eccentric is a cam: or it may be regarded as a crank having a pin larger than the shaft. See Link Motion; Steam Engine.



Eccentric. Metal disk on a shaft fixed out of centre. A and B show two positions of this moving shaft

Ecclefechan. Village of Dumfriesshire, Scotland. It is 6 m. S.E. of Lockerbie by railway, and it has been identified as the original of Entepfuhl in Thomas Carlyle's *Sartor Resartus*. It was Carlyle's birthplace and burial place. Near by are the Roman camps of Birrens and Birrenswark. Pop. 988. See Carlyle illus.

Eccles. Mun. bor. of Lancashire, England. It stands on the Irwell, 4 m. W. of Manchester, of which it is an industrial suburb, and is served by the railway. Famous for Eccles cakes (made of pastry with currants), the town has cotton and other textile industries. It has an old church. It gives its name to a bor. constituency. Pop. (1951) 43,926.

Ecclesfield. Parish of the West Riding of Yorkshire, England. It is 5 m. W.N.W. of Sheffield, and is served by rly. and bus. The Perpendicular church of S. Mary, formerly designated the Minster of the Moors, contains some fine oak carving. There are cutlery and tool works, paper mills, ironworks, and collieries. Pop. (1951) 30,262.

Ecclesia (Gr. *ekkalein*, to call forth). In ancient Athens, the assembly of the whole body of free citizens. The meetings were held in the Pnyx and latterly in the theatre; on special occasions they were held in the agora. In theory the ecclesia was the supreme power in the state, and any citizen had the right to speak; but in practice its power was virtually confined to the business which had been prepared for it by the *boulē*, or council of 500. Voting was by show of hands, and on special occasions by ballot. In addition to some 40 regular meetings a year, the ecclesia could also be convoked for special business by a chief magistrate. The Greek name ecclesia (Fr. *église*) came to be applied in Christian times both to the assembly of Christians and to the place of assembly. See Cathedral; Church.

Ecclesiastes. Title adopted, through the Vulgate, from the Septuagint, for the O.T. book which in Hebrew bears the title *Kōheleth*. The meaning of the Hebrew term is disputed, but may be "one who speaks in an assembly" (hence Jerome's rendering *concionator* and the English translation "the Preacher"). In chap. 1, vv. 1, 12, the writer seems to be identified with King Solomon, to whom tradition ascribed the authorship. But the language of the book, which contains Persian and possibly

Greek words, and represents a transitional stage in the development of Mishnic Hebrew, is that of an age much later than Solomon's. The book cannot, however, be later than Ecclesiasticus (c. 200 B.C.), which pre-supposes its existence. It presents a strange mingling of despair and pessimism ("Vanity of vanities, all is vanity") with an irresistible sense of the goodness of God. Thus the writer's utterances often seem contradictory.

The true explanation seems to be that the book is a series of reflections representing two or more moods, or in other words is the record of the negative and positive phases in a soul's struggle for light. Hence, probably under Greek influence, a philosophic materialism and epicureanism; under the influence of national subjection, a general despondency; and yet, under the influence of an innate religious trend, an unquenchable faith in a divine dispensation. The materialistic element will account for the hesitation with which the book was admitted into the Hebrew Canon. The writer in one mood sees little profit or progress in life; the same happenings recur perpetually (cf. Nietzsche's philosophy). The best course in life seems to be to eat and drink and enjoy things as much as possible. But in another mood the writer realizes that true happiness is dependent upon fear of God and obedience to His commandments.

Ecclesiastical Commission. Body constituted in 1836 to manage the extensive estates of the Church of England. Under its direction the large incomes of certain bishops and other dignitaries were gradually reduced to a more uniform scale.

In certain cases in 1836 the dean and chapter refused to hand over the cathedral estates to the commissioners, and several such incomes were reduced owing to agricultural depression. Those which took the other course received a fixed income whatever the rent-roll of the surrendered estates might be. The commission dealt with an annual income of nearly £2,000,000, and after paying the various stipends it usually set aside some £400,000 a year for increasing the endowment of poor livings and providing for the foundation of new ones.

In 1947 this body was merged in the new Church Commission (*q.v.*), its members becoming known as the Church Commissioners for England. Consult Num-

ber One Millbank: The Story of the Ecclesiastical Commission, J. R. Brown, 1944.

Ecclesiastical Courts. Courts of law that deal with offences against ecclesiastical law, i.e. cases affecting benefices and the like. Such are in their nature confined to the established church. The courts held by the Pope and by the various prelates of the R.C. Church are ecclesiastical courts.

In England clerics are now for practical purposes on the same footing before the law as laymen. Formerly this was not so, and the church courts dealt with all kinds of offences committed by clergymen as well as with all cases affecting marriage (divorce, etc.) and wills—two subjects which the church regarded as peculiarly its own. The process of reducing the powers of the ecclesiastical courts was a gradual one, but by about 1860, the date of the Ecclesiastical Courts Jurisdiction Act, they may be said to have been confined to their present duties, dealing only with cases affecting church discipline, and no longer with any that are offences against the state. In 1855 their jurisdiction in cases of defamation was taken away, and in 1857 they lost that affecting wills and matrimony.

The existing ecclesiastical courts in England are the courts of arches, presided over by the dean of arches, which is the chief court in the province of Canterbury, and the chancery court, which fulfils the same purpose for the province of York, and is presided over by the official principal.

The court of arches hears appeals from the consistory courts, and from it there is an appeal to the judicial committee of the privy council. Until 1833 these appeals were to the court of delegates of appeals, which dated from the time of the Reformation.

Each diocesan bishop has his court, called the consistory court, over which the chancellor of the diocese presides. The archdeacons have courts, which, however, have little to do. Each archbishop has an almost obsolete court of audience, and also the court of the vicar-general, which deals with the confirmation of the election of bishops, gives advice to convocation, and controls the issue of marriage licences. The law administered in the church courts was mainly canon law and English statute law so far as it concerned the Church. See Arches, Court of; Canon Law; Church of England; Curia; Ecclesiastical Law.

ECCLESIASTICAL LAW IN ENGLAND

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This article deals with Ecclesiastical Law, the main branch of which is that under which the Church of England lives and works.

Another aspect of the same subject is dealt with under Canon Law.

See also Church of England

Ecclesiastical law is here used to mean the law affecting the Established Church of England. Other churches are subject to the general common law and statute law affecting corporate or non-incorporate bodies. In the Middle Ages, English ecclesiastical law was the canon law of the western European church, supplemented, and in some cases modified, by the statute law of the realm and by the common law derived from custom. Indeed, it has been argued that the canon law itself was regarded as an undefined part of the common law, probably because it also largely represented the codification of ecclesiastical custom.

The legislation of Henry VIII shifted the centre of gravity of English ecclesiastical law from the canon law to statute law, and the guiding legal principles and maxims of English ecclesiastical law since his time are to be found in his legislation, notably in the Act of Supremacy (1534), modified in the reign of Elizabeth (1559) and of later sovereigns. At the same time, the principles of English common law have been more and more applied to the church.

Relation to Old Canon Law

The exact relation of modern English ecclesiastical law to the old canon law has never been precisely defined by statute, by the courts of the realm, or by any other competent authority. Many of the regulations of the medieval canon law were embodied in the Canons of 1604, which became binding upon the clergy, but not (except in so far as they repeat existing law or apply to church officers) upon the laity. In 1939 a commission was appointed to prepare the first revision of these canons for over three centuries. The recommendations of this commission were published in May, 1947.

The canons of 1604 did not, however, close the door of appeal to the rest of the medieval canon law. Many authorities regard that canon law as part of the English ecclesiastical law, save in so far as any of its provisions conflict with the statute law or custom of the realm. This lack of definite legal precision places English ecclesiastical law at a disadvantage when compared with the *Coder Juris Canonici* (1917) of the R.C. Church.

Another considerable modification of the medieval jurisdiction still surviving in the English ecclesiastical courts took place in 1857, when all cases concerning marriage (other than the grant of marriage licences), divorce, and wills were transferred from the church courts to new secular courts.

The Enabling Act

The Church of England Assembly (Powers) Act (1919), commonly called the Enabling Act, set up a new legislative body for the church called the National Assembly of the Church of England, otherwise the Church Assembly. This consists of the house of bishops, the house of clergy (embodying the lower houses of convocation of the two provinces of Canterbury and York), and the house of laity (elected). When agreed upon, its measures go before the ecclesiastical committee of the two houses of parliament, also created by the Act of 1919. The measures can then be debated by both houses of parliament, but if no debate is demanded, and this is the usual course of procedure, then, after the consent of both houses of parliament has been obtained, the measures go forward for the royal assent, and so become part of the statute law of both church and state. Between 1920 and 1945, over 90 measures of new ecclesiastical legislation were added to English ecclesiastical law in this way, and the process continues.

The church assembly has no power to interfere with the canons or to encroach upon the duties and privileges of the convocation of the provinces of Canterbury and York. These are part of the ancient constitution of the realm, and grew up side by side with parliament—indeed, preceded it. Together with the lords and commons, they formed a kind of third estate, and at one time had the right to authorise separate taxation of the clergy, which differed in amount and incidence from that imposed by parliament upon the laity. The houses of convocation of the two provinces, which sit separately in London and York, may with the royal sanction promulgate legislation of a canonical and doctrinal character, but only so far as it does not infringe the

statute and common law of the land. In comparison with the legislation passed by the church assembly, that undertaken by the convocations in modern times has been small.

Ecclesiastical law relates to the affairs and discipline of archbishops, bishops, clergy, and lay officials of the church, and to the laity generally in all matters where the faith, forms of worship, rites and ceremonies are concerned; to the fabric of the church, rectory and vicarage houses and other buildings which are church property. Revisions proposed in 1947, for example, dealt among other matters with procedure for baptism, qualifications of sponsors and of churchwardens, the hearing of confession, the anointing of the sick, the ordering of deaconesses, and the interchange of pulpits with nonconformists.

Ecclesiastical law is in the U.K. administered in both ecclesiastical and civil courts, with the usual course of appeal, in the case of diocesan courts to the provincial court and the privy council, and in the case of the high court to the court of appeal and the house of lords. The 1947 proposals included suggestions for the simplification of church courts. *Consult Law Relating to Church and Clergy*, H. W. Cripps, 7th ed., 1921.

Ecclesiastical Titles Act. Act passed by the British parliament in 1851. It was a reply to the brief of the Pope Pius IX which restored the Roman Catholic hierarchy in England, making Westminster an archbishopric and selecting various towns, not occupied by Anglican bishops, as new seats for the episcopate. In response to Protestant political agitation Lord John Russell introduced the bill, which was passed into law. The Act was from the first a dead letter, and was repealed in 1871.

Ecclesiasticus. Name in the Vulgate of one of the most important of the O.T. Apocrypha, which in the Greek version is called the "Wisdom of Jesus, son of Sirach." The book was called Ecclesiasticus ("belonging to the Church") because, though not canonical, it was considered suitable for use in the public worship of the Western Church. By the decree of the Council of Trent it was declared a canonical book of the O.T. in the Roman Catholic Church.

It was originally written in Hebrew, between about 190 and 170 B.C., by Jesus the son of Sirach and was translated into Greek soon after 130 B.C. by a grandson of the

same name. The Hebrew text was lost until 1896, when Mrs. Agnes Lewis discovered a fragment in Palestine. Subsequently other fragments came to light, and now the greater part of the work can be read in Hebrew. The book belongs to a class of Hebrew literature known as Wisdom Literature. The author gathers up ethical proverbs, precepts, and wise sayings concerning various matters in the conduct of life. See Apocrypha.

Ecclesiazusae. Comedy of Aristophanes, produced 392 B.C. It represents the women of Athens as controllers of public affairs and founders of a socialistic state in which property and husbands were held in common, as in Plato's Republic. The title means Women in the Ecclesia (general assembly).

Ecclesiology (Gr. *ekklesia*, church, assembly; *logos*, discourse). Science treating of the organization and development of Christianity and of ecclesiastical architecture and decoration, especially in regard to their liturgical significance. See Christianity; Church.

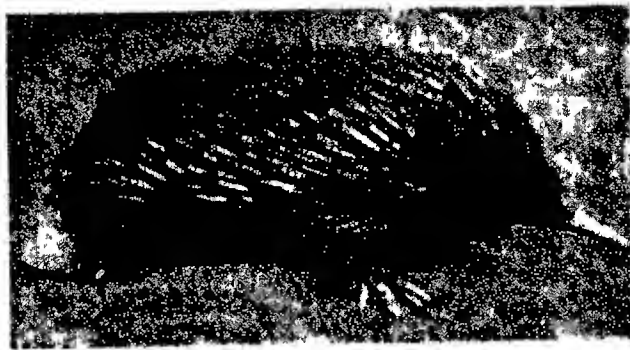
Ecdysis. Zoological term for the shedding of a skin or shell, e.g. of an insect or crustacean. The cast skin is the exuviae and the intervals between successive ecdyses during the life of the animal are instars.

Echegaray y Eizaguirre, José (1832-1916). Spanish dramatist, poet, and politician. He was born, April 4, 1832, at Madrid, and educated at its university. Before entering politics, 1868, he was a teacher of mathematics. He held office in the Radical-Monarchist government of 1872-73, as minister of education, and in 1874 and 1905-06 was minister of finance. His versatility was extraordinary, and he was a director of commercial companies, as well as a philosopher and poet. In 1904 he won the Nobel prize for literature. His dramas, numbering over eighty, have been translated into most European languages, and he is regarded as the founder of the new school of Spanish dramatists. The plays include *Mariana*, 1893, adapted in English, 1897, at the Court, and revived, with Mrs. Patrick Campbell in the title rôle, at the Royalty, 1901; *El Gran Galeoto*, 1881, produced in London, 1889, under the title of *Calumny*. Echegaray died Sept. 16, 1916.

Echelon (Fr., rung of a ladder). Military term. Troops, warships or aircraft are said to be in echelon formation when the second unit is to the rear and to the

flank of the leader, the third similarly placed in relation to the second, and so on. In the case of aircraft in echelon, each machine is usually stepped in relation to that immediately in front. This is to provide additional defensive protection to the formation. The army uses the term B echelon for second-line transport, etc., and servicing units attached to R.A.F. bomber, fighter, and transport squadrons are also known as echelons.

Echidna. Spiny ant-eater of Australia and New Guinea, of which there are two species, the



Echidna. An egg-laying mammal of Australia

five-toed and the three-toed. They are egg-laying with a common opening of genital ducts, urethra, and rectum called a cloaca, and are thus Monotremata. The back of the head and body is covered with short spines, like porcupine quills, and the head is provided with a slender beak. In the breeding season the female lays a single egg, which is incubated in a pouch on the underside of the body.

Echinodermata (Gr. *echinos*, hedgehog; *derma*, skin). Phylum of invertebrate marine animals. They comprise the feather-stars (Crinoidea), star-fishes (Asteroidea), brittle-stars (Ophiuroidea), sea-urchins (Echinoidea), and sea-cucumbers (Holothurioidae); certain other orders are represented only by fossils. They are organized on a five-rayed symmetrical plan, though this is not at once evident in some of the sea-cucumbers. The skeleton consists of a soft integument in which is deposited carbonate of lime in the form of plates, bars, or spicules. Although there is no distinct head, there is a mouth on the underside, except in the sea-cucumbers, where it is placed at one of the two extremities.

The nervous system has its principal seat in a five-angled ring around the gullet, from which branches radiate in all directions. There is no heart; but there is a system by which the products of digestion are circulated. Of a complex system of coelomic spaces, one set accounts for the most remarkable feature of echinoderm organization: the series of water-vessels

known as the ambulacral system from its function of supplying hydraulic power for locomotion.

The outer surface of the echinodermis varies in the several orders. In the sand-stars and brittle-stars it consists of overlapping plates which allow the rays to be thrown into horizontal curves; in the common star-fish and its near allies it is studded with hard bosses and short spines; and in the sea-urchins it is armed with long or short spines which move on ball-and-socket joints. There are also sense organs of varying character in the different groups. The star-fishes have rudimentary eyes at the tips of the rays.

The echinodermata are of the widest distribution, being found in all seas, at all depths. They are an ancient group, for their fossil remains are found in rocks as far back as the Ordovician period.

Echinoidea (Gr. *echinos*, hedgehog; *eidos*, form). Order of echinodermata containing the sea-urchins. They include regular urchins, of which the somewhat spherical common sea-urchin (*Echinus esculentus*, of rocky British coasts is a familiar example; the oval heart-urchins (e.g. *Echinocardium*) of the sandy shores; and the depressed cake-urchins (*Clypeaster*), which are not represented in British waters.

The common sea-urchin has beneath its coat of about 4,000 bristling spines, a thin stony box composed of nearly 600 five-sided plates, placed edge to edge. Through the minute perforations issue the delicate sucker tubes of the ambulacral system (see Echinodermata). Some of the plates bear polished bosses upon which the spines turn in any direction. Each tapering spine has a polished cup at its base to receive the boss, and the two are held together by muscular tissue. Among the spines will be found stalked and sessile organs resembling the bills of birds, which have the power of snapping; these are called pedicellariae. Around the Mediterranean the sea-urchin is esteemed as food; hence its name *esculentus*. The gonads are edible and a rich source of vitamin A.

The heart-urchins, which burrow in muddy sand, are clothed with silky bristles, all pointing backwards. The scoop-like mouth is at the broad end and without teeth.

Echmiadzin. A monastery in Armenia S.S.R. It stands 12 m. W. of Erivan and 40 m. N. of Mt. Ararat. Its foundation is attributed to S. Gregory the Illuminator in 302, and since 1441 it has

been the patriarchal seat of the Armenian Church. Many tombs, relics, and manuscripts are shown. The neighbouring town is Vagarshapat, but Echmiadzin has given its name to an administrative district.

Echo. A sound caused by reflection of sound from a suitable surface such as a wall or rock-face. It may be heard quite distinctly from the direct sound if the observer is suitably placed with respect to the source and the reflecting surface. The rolling of thunder is due to numerous successive reflections between surfaces of clouds.

Echo. In Greek mythology, a mountain nymph. At one time the companion of Hera, having displeased the goddess, she was punished by being rendered incapable of speaking except when spoken to. Subsequently Echo fell in love with the beautiful Narcissus, but, her love not being returned, she pined away and was changed into a stone which retained the echo or answering voice.

Echo Sounding. Electro-sonic method whereby ships take automatic soundings of the sea bed over which they are passing. First developed during the First Great War for detecting the presence of enemy submarines, the echo sounder came to be used instead of the lead with which mariners used to estimate depths of water.

By the opening and shutting of a control switch, an electrical current is passed from a charged capacitor through the windings of a transmitter and causes a sound impulse to be emitted. This impulse is reflected, or echoed, back from the sea bed or any obstacle in its path and picked up by the receiving portion of the instrument. After being amplified, the sound impulse actuates a stylus which records, on a revolving strip of sensitised paper, marks proportional to the time taken for the echo to return from its source to the instrument. The number of echoes received ranges from 75 to 400 a minute, according to the instrument.

As the rate at which an echo travels through water is known, it is possible to calculate with fine accuracy the depth of the object returning the echo. The stylus moves to the right or left of a central line on the paper, and its successive marks form a continuous contour or graph. This graph shows the smallest variation of water depth, and gives an indication of the character of the sea

bed; the thicker the line on the paper, the harder the bottom. The echo sounder is equally responsive in deep or shallow water.

Most large liners are fitted with echo sounders, as are colliers bringing coal to the power stations and gasworks on the banks of the Thames. Many trawlers carry echo sounders to detect the presence of shoals of fish, or any obstacles that might destroy nets. Whaling factory ships use echo sounders that will respond to a whale two miles away. The instrument was used to survey the bottom of the English Channel preparatory to laying the oil pipe line (see Pluto) between England and France in 1944.

Detectors making use of the sonic principle have been applied to industry for detecting flaws in metal castings. The instrument transmits ultrasonic pulses into the metal under test and measures the time it takes the pulses to travel through the material, reflect from the opposite side or from a defect, and return to the point of origin. Ultrasonic waves travel best in solids and, as they weaken when in contact with air, register on a meter when they strike an air hollow or flaw in a metal casting.

Echternach. Town of Luxembourg. It stands on the Sure, near the frontier of Germany and is famous for its annual festival and its association with S. Willibrord. In the church, a Romanesque building of the 11th century, restored in the 19th, were the remains of the saint. There was a rich Benedictine abbey here until 1801. The festival, which dates from 1300 or earlier, is held every Whit Tuesday. It is attended by pilgrims and invalids, as well as high ecclesiastics, who are accompanied by a singing and dancing crowd as they go in procession to the church. Echternach had a town hall and some small industries.

Southernmost point at the base of German penetration in the Ardennes counter-offensive, Dec., 1944-Jan., 1945, Echternach changed hands more than once during hard fighting, but the stubborn American defence prevented the enemy from overrunning it and extending his advance southwards.

Echuca (formerly Hopwood's Ferry). Town of Victoria, Australia. It stands on the Murray river, 156 m. by rly. N. of Melbourne. It is the chief river port on the Murray at its junction

with the Campaspe. A bridge (rail and road) 1,905 ft. in length spans the river here, connecting with Moama in New South Wales. Echuca is the outlet for the wine, wool, and timber of this district. A rly. line 45 m. long to Deniliquin, on the Edward river, taps part of the N.S.W. Riverina trade; and Echuca is also connected with Bendigo. Pop. (1954) 5,407.

Écija (anc. Astigi). Town of Spain, in the prov. of Seville. It stands on the Genil, here crossed by an old bridge, 34 m. by rly. S.W. of Córdoba. Écija, once a Roman colony (Julia Augusta Firma) and a Moorish town, retains many traces of ancient civilization. It manufactures boots and shoes, soap, pottery, and textiles. The surrounding fertile plain produces corn, cotton, and olives; the vine is widely cultivated, and a fine wine is made. From its climate Écija is popularly called the frying-pan of Andalusia. Pop. (1950) 41,679.

Eck, JOHANN MAIER VON (1486-1543). German theologian. He was born at Eck, in Swabia, Nov. 13, 1486, his father's name being Maier. Having studied at Heidelberg, Tübingen, and elsewhere, he was ordained priest in 1508. Two years later he became professor of theology at Ingolstadt university, with which he was associated for the rest of his life. The ablest opponent of the Reformation in Germany, in June-July, 1519, he debated publicly at Leipzig with Luther and Carlstadt, then wrote a treatise on the Primacy of Peter, and went to Rome. He returned with the papal bull excommunicating Luther (*q.v.*). Eck organized the Catholic Federation, and took a prominent part in successive conferences and diets at Ratisbon, 1524; Baden, 1526; Augsburg, 1530; and Worms, 1540. His German version of the Bible was published in 1537. He died Feb. 13, 1543.

Eckener, Hugo (1868-1954). German engineer and airman. Born at Flensburg, Aug. 10, 1868, he



Hugo Eckener,
German engineer and
airman

was at one time a mathematician, economist, and psychologist, and later assisted Count Zeppelin in building airships. In 1908 he became Zeppelin's deputy and in 1911 his successor. During the

First Great War and after, Eckener continued to design and pilot Zeppelin airships. He designed the Graf Zeppelin (*q.v.*), piloting it round the world in 1929, and in 1931 flew over the North Pole. A staunch democrat, he was, after the defeat of Germany in 1945, invited by the French occupation authorities to play a political rôle; and edited *Süd Kurier*, the most important daily paper of that zone. He died at Friedrichshafen Aug. 14, 1954.

Eckermann, JOHANN PETER (1792-1854). German writer. He was born at Winsen, Hanover, Sept. 21, 1792. After early hardships he served in the war of 1813-14, and later studied at Göttingen. In 1822 he sent Goethe the MS. of his *Beiträge zur Poesie*, and this resulted in his going to Weimar, where he acted as secretary to Goethe, and assisted in the preparation of the final edition of his writings. Eckerman is best remembered by his *Gespräche mit Goethe* (1836-48), Eng. trans. John Oxenford, 1850. He died at Weimar, Dec. 3, 1854.

Eckhart, JOHANNES (c. 1260-1327). German mystic and theologian. Born at Hochheim, near Gotha, he became a Dominican friar, and in 1298 was prior of Erfurt and provincial of Thuringia. In 1300 he was lecturer in Paris, and in 1307 he was vicar-general of Bohemia and provincial of Saxony. He was subsequently lecturer at Paris, Strasbourg, and Frankfurt, and from 1320 until his death was professor at Cologne. Certain expressions used by Eckhart were condemned as heretical, and he was suspected of pantheism. But he made complete repudiation of error and submission to Rome.

Eckhart, who is known as the Master, was the founder of German mysticism. His writings do not present a definite system of philosophy, and his teaching is mainly concerned with the Divine essence in all things, the relation of the human soul to God, and the attainment of God by casting off all that hinders knowledge of God. No complete English trans. of his works exists. *Consult* *Deutsche Mystiker des 14 Jahrhunderts*, ed. F. Pfeiffer, 2nd ed. 1907.

Eckington. Parish and town of Derbyshire, England. It stands on the Rother, 6½ m. S.E. of Sheffield, with a rly. station. Agricultural implements are manufactured, and there are coal mines in the neighbourhood. Market day, Fri. Pop. 15,000. Another

Eckington, in Worcestershire, is close to the Avon and Bredon Hill.

Eckmühl, BATTLE OF. Victory of Napoleon over the Austrians, April 22, 1809. In an attempt to reopen his communications, which had been broken by the French, the archduke Charles emerged from Ratisbon to give battle. His troops were routed by Davout and Oudinot, and the whole Austrian army was demoralised and forced across the Danube. For his part in the day's success Davout was created prince of Eckmühl.

Eclampsia. Term applied to a condition in which convulsions occur before, during, or after childbirth. These convulsions are due to failure of the maternal kidneys to excrete the toxic load of the mother and foetus. The condition can be diagnosed at its onset by a rise in blood pressure and by presence of albumen in the urine. The careful obstetrician records the blood pressure of the pregnant woman and examines the urine for albumen as routine measures. Should the blood pressure rise, and should albumen make its appearance, the treatment is complete rest, a diet of water and vegetables, and hourly observation of the case. Termination of the pregnancy by induction of labour or by caesarian section may be necessary.

Eclecticism (Gr. *eklektikos*, picking out). In philosophy, a method which, while not excluding independent thought, selects and works up into a whole what is acceptable in other philosophical systems.

The most important Greek representative of this practice, which first made its appearance in the Stoic school, was Antiochus of Ascalon (1st century B.C.), the head of the so-called Fifth Academy, whose teaching led to the adoption of eclecticism by the Academy in place of scepticism as

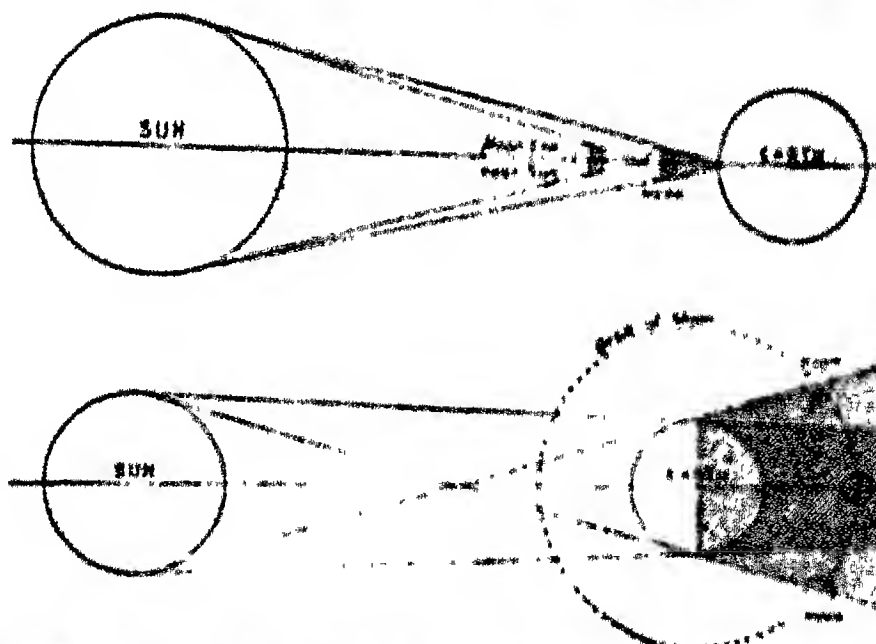
its ruling principle. Among the Romans, Cicero, who attended his lectures at Athens, although by no means an original thinker, skilfully selected and combined Sceptic, Stoic, and Peripatetic doctrines. Among modern eclectics Leibniz and Victor Cousin may be specially mentioned.

Eclipse (Gr. *ekleipsis*, failing to appear). In astronomy, the temporary interruption of the light from a celestial body. Eclipses fall into two classes: (1) If the eclipsed object is self-luminous, an eclipse will occur if a dark body is interposed between it and the earth. The best example of this is an eclipse of the sun, when part of the earth's surface is covered by the moon's shadow. A similar phenomenon occurs when the orbit of a binary star (*q.v.*) lies edge-on to the earth. (2) If the eclipsed body shines by reflected light, an eclipse will occur if a dark body comes between it and the source of light. An eclipse of the moon is of this type, the moon passing into the shadow cast by the earth. Eclipses of planetary satellites (*e.g.* the moons of Jupiter) by their parent bodies also fall into this class.

If the earth, the sun, and the moon moved in the same plane, there would be an eclipse each time the three were in a straight line. Since, however, the moon moves in an orbit inclined at an angle of 5° 8' to the plane of the sun's path, the ecliptic (*q.v.*), there can be an eclipse only when the moon is crossing the plane of the ecliptic. The points where the moon crosses the ecliptic are called the nodes, and when new moon happens at one of these nodes there will be an eclipse of the sun. When full moon occurs at one of the nodes the earth is between the moon and the sun, and there will be an eclipse of the moon by the earth's shadow.

An eclipse of the moon will be visible to the whole side of the earth turned away from the sun. But in a solar eclipse the moon casts only a restricted shadow on the earth, and therefore the sun will appear in total eclipse only in the narrow path of this moving shadow.

Owing to the refraction of the



Eclipse. Diagram showing the phases of an eclipse of the moon by the shadow of the earth. Top, eclipse of the sun by the moon. When the moon is too near the sun there is an annular eclipse.

sun's rays by the earth's atmosphere into the geometrical shadow, the moon is hardly ever quite swallowed up in blackness. A total lunar eclipse may last about 1 hour 45 minutes. If the moon is not exactly at the node at its eclipse a partial eclipse will result, the lower or the upper limb of the moon being obscured by the umbra, or darker portion of the earth's shadow.

In a total eclipse of the sun by the moon the diameter of the moon's shadow cast on the earth averages only about 150 m. and sweeps across the earth from W. to E. with great rapidity. The eclipse can be visible only in places swept by the shadow, and the longest time the total eclipse of the sun by the moon can be visible at any place is a little more than seven minutes.

Partial eclipses occur when the new moon is not quite at the node; annular or disk-like eclipses are due to the fact that the moon is sometimes too far from the earth to hide the sun entirely from the view of an observer on the earth. The length of the cone of the moon's shadow varies with the moon's distance from the sun between 228,000 and 236,000 m. The moon is sometimes as near as 221,700 m. to the earth, and sometimes 252,400 m. away, so causing the variation both in the appearance and the length of time of solar eclipses.

The maximum possible number of eclipses of the sun and the moon in any one year is seven. This happened in 1935 and will not occur again for two centuries. The minimum is two (both solar). Although there is no actual connexion between one eclipse of the sun or moon and the one immediately following, there is a cycle, known as the Saros, of a little over 18 years of eclipses, and it was owing to a knowledge of this fact that the ancients were able to predict eclipses of the moon, though since eclipses of the sun are very rare at any given place on the earth's surface, the similar sun cycle was overlooked.

Eclipses of the sun have been fruitful in discovery, for only when the bright disk is covered can the sun's atmosphere be effectively studied. The eclipse of 1868 resulted in the discovery of helium in the sun, 27 years before it was found to be a constituent of one of the rare earths, cleveite. The eclipse of 1919 provided an opportunity to prove Einstein's generalised theory of relativity by show-

ing that light was attracted by the sun and deflected from a straight path.

As a total solar eclipse occurs only over a limited track on the earth's surface, astronomers make expeditions with portable equipment to study it. Total lunar eclipses can be seen over half the earth but are of little scientific interest. The last total solar eclipse visible in Great Britain was on June 29, 1927, when a Greenwich expedition studied it from Giggleswick, Yorks; the next will be on Aug. 11, 1999, visible in Cornwall. See Corona; Ecliptic; Moon; Occultation; Sun; Consult also Eclipses of the Sun and Moon, Sir F. Dyson and R. Woolley, 1937.

Eclipse. English racehorse, regarded as the greatest that has ever lived. Foaled April 1, 1764, he was named because on that day there was an eclipse of the sun. He ran in his first race May 3, 1769, and from then until Oct., 1770, ran in 18 races, never being beaten. He was bred by the duke of Cumberland, but at the time of his successes was the property of D. O'Kelly. After 1770 he was used for stud purposes. The horse's skeleton was placed in the Royal Veterinary College, Camden Town.

Eclipse Stakes. Race for horses of 3 years and upwards run at Sandown Park over a distance of 1½ m. It was inaugurated in 1884 and formed the first of the £10,000 races. Danny Maher rode the winner of this event on five occasions. One of the most popular wins was that of Orme, after recovering from his supposed poisoning, in 1892. See Horse Racing.

Ecliptic (Gr. *ekleiptikos*, relating to an eclipse). Track in the heavens along which the sun appears to move backwards amongst the stars in the course of a year; so called because the moon must be on this great circle if an eclipse is to occur. The sun's motion is only apparent; it is the motion of the earth about the sun which produces the appearance of the sun's itinerary. The plane of the ecliptic is the plane of the sun's apparent, and of the earth's real, motion. The obliquity of the ecliptic is the angle ($23\frac{1}{2}^{\circ}$) the ecliptic makes with the celestial equator. Since the orbits of the moon and planets are nearly co-planar with the earth's, all these bodies in their wanderings stay close to the ecliptic. The celestial zone containing the ecliptic is the zodiac. See Sun; Zodiac.

Eclogite (Gr. *eklogos*, picked out). Crystalline metamorphic rock having the same general com-

position as gabbro or basalt, from which it may have been derived by heat and pressure. When freshly broken it presents a beautiful appearance due to red garnets in a green matrix of omphacite (pyroxene) and smaragdite (amphibole). It occurs in irregular masses in schists; some geologists think it forms an irregular layer in the earth below the crust.

Eclogue (Gr. *eklogē*, selection). Pastoral poem relating the lives and loves of shepherds. Properly almost identical with the idyll, the term is generally restricted to pastoral poems in dialogue form, such as the *Bucolics* of Virgil. Spenser set the fashion anew with his *Shepherds Calender*, and the form was common in the artificial poetry of the 17th and 18th centuries. The name has sometimes been used for dialogue poems other than pastoral, as in Phineas Fletcher's *Piscatory Eclogues* (1633) and John Davidson's *Fleet Street Eclogues* (1893-96).

Ecnomus. Headland on the S. coast of Sicily, between Agrigento and Licata. Off here in 256 B.C. the Romans under Regulus utterly defeated the Carthaginian fleet.

École des Femmes, L' (The School for Wives). Five-act comedy by Molière, first produced at the Palais-Royal, Paris, Dec. 26, 1662. The scene is in Paris. A selfish, middle-aged bachelor, Arnolphe, brings up a young girl, Agnes, to make her his wife, keeping her ignorant of the world; but fails to prevent her from falling in love with Horace, a son of his old friend Oronte. Unaware of Arnolphe's relation to Agnes, Horace reveals to Arnolphe his love story. The lovers do not meet before the audience until the last act. Molière acted the part of Arnolphe.

École des Maris, L' (The School for Husbands). Three-act comedy by Molière, first produced at the Palais-Royal, Paris, June 24, 1661. The theme of two brothers, Ariste and Sganarelle, in charge of two wards, sisters, whom they desire to marry, was suggested by *The Adelphi* of Terence. Ariste is generous as Sganarelle is mean and masterful. Molière acted the part of the latter. The scene of the play is laid in the French capital.

Ecology (Gr. *oikos*, house, *logos*, discourse). The study of living things in their natural surroundings. It shows that particular organisms are normally to be found in certain habitats, and hence leads to the view that the conditions in the habitats are suitable for their life. The

conditions, or ecological factors, resolve themselves into a purely physical group such as temperature, humidity, light intensity, and kind of soil; and a biotic group, due to the activity of organisms, such as the effect of grazing, shading, availability of organic food. Organisms living under particular sets of conditions constitute communities of which various categories are recognized. The clan is formed of members of one species; the society and the association of more than one. In mixed communities one or more types dominate.

Organisms often modify the environment in which they live and so render it more favourable to less prosperous inhabitants or for the establishment of invaders. Either will then augment the competition within the community, and prosperous species may suffer, even to the point of suppression. Alternatively changes in communities may be caused by factors originating from without. Ultimately in any succession there is produced a community with innate equilibrium, consisting of organisms best suited to the environment with a limited number of dominant species so constituted that they prevent others attaining a higher degree of importance. (*Consult The Ecology of Animals, C. Elton, 1933. Animal Ecology, A. S. Pearse, 1939; The British Islands and their Vegetation, A. G. Tansley, 1939.*)

Economic Man. Term used to describe man as discussed in the works of Ricardo, John Stuart Mill, and other political economists. He is a person who is actuated solely by material interests, who judges every transaction by the loss or gain afforded to him. Later writers have emphasised the fact that man is not actuated solely by material considerations, and have disputed the existence of economic man.

In the mass and in the long run men tend to act along certain well-defined lines, e.g. they tend to stop production which does not pay. Hence it is useful to conceive an average man whose family is of average size, whose needs are satisfied in an average way, whose work yields an average return, and so on. Such an imaginary economic man provides a ready standard of comparison. Just as the mathematician needs the perfect circle which does not really exist, so the political economist postulates an economic man for the study of his science. See Economics.

ECONOMICS: THE STUDY OF COMMERCE

F. C. C. Benham, Prof. of Commerce, University of London

A description of the field of man's activities—namely, the satisfaction through commerce of his needs of food, clothing, housing, and occupation—with which economics deals, and of how it formulates explanations of the changing conditions within that field

The main purpose of economic activity is to satisfy the wants of people for food, clothing, housing, and all the other commodities and services which they consume and which constitute their standard of living. The central economic problem for any community is how to make the best use of its labour and resources. All wants cannot be completely satisfied. The problem is to satisfy them as fully as possible from the means of production available. These means of production—labour, land, and capital (physical assets)—are limited in amount. Many of them are capable of alternative uses. Youths and girls can enter any one of a number of occupations, some workers can move from one industry to another; some land can grow any one of several crops or can be used for pasture, or for building sites; and many buildings and machines can serve any one of several purposes. The community must, therefore, choose what assortment of goods and services shall be produced out of the infinite number of assortments which it could produce. Hence Professor Robbins, in *The Nature and Significance of Economic Science*, has defined economics as "the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses."

Methods of Organization

One method of dealing with this problem is by complete central planning, as in Soviet Russia. A good deal has been written on the merits and defects of this form of social organization. But most countries retain the institutions of private property, freedom of enterprise, and freedom of choice by consumers, all subject to greater or less control by the state. Hence most economists writing in English assume the more common framework of social institutions.

Under these conditions, the problem is solved mainly through the price-system. A large part of economic analysis deals with the formation of prices, and the relations between prices: in other words, with the theory of value and its applications. Everything which can be exchanged for money has a price: for example, wage rates in different occupations and

rates of interest are prices, and form part of the price system. The price of a commodity or service tends to equate the demand for it (the amount which buyers are willing to take at that price) with the supply of it (the amount which sellers are willing to sell at that price). Demand reflects the preferences of consumers and the relative spending power of different consumers; supply reflects the relative scarcities of the various commodities and services. The demand for means, or factors, of production is derived from the demand for the commodities and services which they help to produce. In the absence of monopoly, the price of a factor tends to equal the value of the addition which an extra unit of that factor would make to output (known as its marginal product) and the price of a commodity tends to equal the extra money cost of producing a further unit (known as its marginal cost).

How the Price System Works

In the absence of monopoly, therefore, the central economic problem would be met in the following way. An increase in the demand for a commodity would tend to raise its price; that industry would become a specially attractive field for investment; labour and other factors of production would be directed towards that industry, where they could now earn more; and so more of that commodity would be produced in response to the increased preference for it of consumers. An increase in the supply of a commodity, due perhaps to a big harvest or to an invention which reduces costs of production, or to the movement of labour and capital to an industry in excess of the limits of demand at a high price, tends to reduce its price and thereby to expand its sales. Conversely with decreases in demand or supply. Costs represent alternatives forgone, for they are sums of money paid to attract factors away from other industries, where they could contribute (nearly) the same value to output.

But the price system does not work perfectly. While 19th century industrialists considered it good policy to make a small profit on a

great many items, in the 20th century it was found to pay a monopolist deliberately to keep down output in his field in order to raise prices and increase profit on each item. Economics studies these phenomena of monopoly and imperfect competition, associated with trade marks and advertising. It is generally agreed that the state should supplement the price system by preventing or controlling monopoly and by paying for services such as defence and public health and education which private enterprise would not provide adequately.

Economic activity under free enterprise has large swings up (booms) and down (slumps); mass unemployment often occurs during the slumps. Hence economics studies the nature and causes of this "trade cycle" to discover whether general economic depressions, or slumps, can be avoided.

An important contribution to economic theory in general, and especially to this branch of it, was made by J. M. Keynes (Lord Keynes) who published in 1933 *The General Theory of Employment, Interest, and Money*. He showed that if people spent less, in order to save more, this tended to create unemployment unless it was offset by increased expenditure on "capital goods" such as buildings, ships, plant, and machinery. Much has been written, largely inspired by this book, on methods of preventing mass unemployment. Suggestions include public works, control of investment, and deliberate budget deficits when slumps threaten.

Fluctuating Value of Money

Industry and trade on the modern scale would not be possible without the use of money. Money is a generally acceptable purchasing power. A man will take it in exchange for his goods and services because he knows that others in turn will take it from him in payment for what he wants to buy. The purchasing power of the monetary unit may change from time to time. If it falls (in other words, if the general level of prices rises), this hits people on fixed incomes and creditors due to receive fixed sums of money, for the money buys less than it used to do. On the other hand, the prospects of a rising price level often stimulate borrowing and economic activity, although sometimes firms embark on enterprises which do not survive after prices cease to rise. The theory of money and banking deals with

these questions, and also how changes in the amount of money and in the desires of people to hold money rather than income yielding securities ("liquidity-preference") may affect the rate of interest.

The theory of international trade explains why a country specialises in the production of certain commodities which it exports in exchange for others, which it imports; and discusses "the terms of trade"—what forces determine the volume of imports a country gets in exchange for a unit of exports. A country also engages in other transactions with the rest of the world. It may receive payments as interest or profits on its foreign investments, or for shipping and other services which it renders, or from tourists. All the various payments which it makes and receives together form its balance of payments. Equality between its payments and receipts can be attained in various ways. These include changes in the rate of exchange between its currency and other currencies; restrictions on imports and subsidies on exports; and, under fixed exchange rates, inflation or deflation of the national money income. The money income of a person for a year is his total receipts, including the value of any items such as farm produce which he produces for his own consumption, less his business expenses. The national income for a year is the net sum total of all incomes of persons, firms, and institutions for that year. It must be measured net. For example, dividends paid by companies must not be counted in the incomes of the companies as well as in the incomes of the shareholders; income tax must not be counted in the incomes of both the taxpayers and the government.

How to Assess National Income

The national income of a country is the best single measure of its economic position, but for comparison with other years or with other countries allowance should usually be made for differences in population and in the purchasing power of money. The latter allowance can be made by taking some year as the "base" year and then altering the money figures for other years to make them represent money units of the same purchasing power as in the "base" year. The result gives a comparison of "real," as opposed to "money," income. For example, if in the year 2000 the

price level should be twice as high as in 1950 (taken as the base year) the actual national income of 2000 should be divided by two in order to compare it with that of 1950.

The main determinant of real income is the volume of production. This is influenced by many factors. These include the natural and acquired capacities of the people, and the natural resources and other assets (the size of the population relative to these resources, the amount of specialisation, and the state of technical knowledge) of a country. Part of the economic activity of a country is devoted to providing for the future by increasing productive equipment, and improving health and knowledge; this investment keeps down current consumption, but tends to increase future output.

Increase of Technical Knowledge

The great economic progress which has taken place in the western world over the last hundred years or more has been due to the continued growth of technical knowledge combined with increased investment and greater specialisation, including large-scale production. But technical progress may be offset by over population, by wars, or by natural catastrophes.

The study of economics is an aid to clear thinking and is useful to the citizen as well as to the statesman. Economists do not always agree among themselves on practical issues. This is usually for one or both of two reasons. In the first place, these issues may involve personal judgements about the extent to which one aim (for example, greater output) should be sacrificed to another aim (for example, greater equality or social security). In the second place, they usually involve forecasts about how people would respond to the proposed measures. But the citizen should know enough economics to form his own judgements on these issues of policy.

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Economics and Political Science, LONDON SCHOOL OF. This college of the University of London founded in 1895 for the study of the social sciences is described under the heading London School of Economics (*q.v.*).

Oxford, Glasgow, Manchester, and Birmingham Universities have Economics departments.

Economic Secretary. Official of the British Treasury. The holder of the appointment, a political one, is a junior member of the government; it is his duty to advise the chancellor of the Exchequer on economic policy. The post was created in 1947; it lapsed in 1950 and 1951-52, when the govt. included a minister of state for Economic Affairs.

Economic Warfare. Engendering paralysis of the enemy's war machinery by depriving it of materials. Great Britain's economic warfare against the Axis powers, 1939-45, was conducted by a ministry (*v.i.*) whose function was to starve the enemy of raw materials for munitions, oil, grain, fats, cotton, and every imported commodity that might be useful. A blockade was instituted and a number of contraband control stations established, at which neutral ships were searched for contraband cargo. Exports from Germany were also blockaded. A form of passport, called a navicert (*q.v.*), was issued at the port of shipment to cover legitimate cargoes.

A secondary arm of economic warfare was the purchasing of supplies in neutral countries to prevent their going to enemy countries. Some targets bombed by the R.A.F. were selected by the ministry, especially dams, transport centres, synthetic rubber plants, and oil refineries. Examination by experts of material captured on the battlefield revealed certain shortages in enemy countries and suggested where such air attacks might prove most effective.

Another method of tightening controls of enemy imports and exports was the use of black lists: lists of persons and firms, chiefly in neutral countries, known to be cooperating with the enemy. No navicerts or export licences were issued to anyone on these lists, or suspected of acting for black-listed firms. See Black List; Blockade.

Economic Warfare, MINISTRY OF. Department of the British government during the Second Great War. It was formed on Sept. 3, 1939, the first minister being R. H. Cross, and had tasks

analogous to those of the ministry of Blockade set up during the First Great War, namely, to disorganize the economic life of the enemy in order to reduce his capacity for waging war. The ministry was dissolved in May, 1945, its functions in the Far East being undertaken by the Foreign office.

Economiser. Extension of the feed water pipe-line of a steam boiler, comprising a nest of tubes placed in the flue gas exit to utilise waste heat by additional heating of already warmed feed water. The water should be preheated to 120° F. to prevent undue cooling of the flue gas, as condensation of moisture in a highly sulphurous atmosphere would cause severe external wastage of the tubes. The preheater may use exhaust or live steam, or heated feed water may be by-passed back to mingle with the incoming cold water. An economiser also provides a reserve of hot feed water against peak load demands, and helps to reduce scale formation in the boiler by receiving the bulk of the sludge precipitated from temporary hardness. The outsides of the tubes are cleaned by steam-jet soot blowers, or mechanically operated scrapers. Saving in fuel may amount to 10 p.c.

Economist, THE. A London weekly paper devoted to political economy. It was founded in 1843 by James Wilson, who edited it until 1859, Herbert Spencer being sub-editor, 1848-53. During 1859-77 the paper was edited by Walter Bagehot; 1907-16 by Francis W. Hirst; 1922-38 by Sir Walter Layton; 1938-56 by (Sir) Geoffrey Crowther. The Economist has always discussed financial questions from a social and economic standpoint, and in its early days was a staunch advocate of free trade and the repeal of the Corn Laws.

E.C. Powder. One of the oldest British smokeless powders for use in sporting guns. Invented in 1882 at the works of the Explosives Company, hence E.C., at Stowmarket, it consisted essentially of nitro-cellulose mixed with nitrates and moderants. The powder is prepared in granular form suitable for loading. It is a 33-grain powder, *i.e.* 33 grains of the smokeless powder is equivalent to the old standard charge of 82 grains of gunpowder.

Écrins, BARRE DES. Mt. of S.E. France. It is the highest summit of the Pelvoux group of the Cottian Alps, which lie between the depts. of Hautes-Alpes and Isère. Alt. 13,460 ft.

Ecstasy (Gr. *ecstasis*, displacement, trance). A name given to various states of consciousness, in which, the mind being concentrated on a definite object, the senses are temporarily inactive, and external sensations inoperative. It has been experienced at various times by many Christian mystics, notably by S. Teresa, and valued as a supernatural phenomenon. According to their own testimony the mystics have received, in ecstatic condition, special manifestations of the will of God. The term is also sometimes applied to the abnormal mental conditions of catalepsy, the hypnotic trance, somnambulism, and to the trances of spirit mediums. The chief points distinguishing these states from ecstasy are the absence of consciousness and of all memory of what has taken place during the trance. See Dreams.

Ectoderm (Gr. *ectos*, outside; *derma*, skin). Term applied to the outer layer of the embryo, from which the skin and nervous system of a vertebrate animal originate. It is also used for the outer layer of cells in the Coelenterata. See Embryology.

Ectopic Gestation OR EXTRA-UTERINE PREGNANCY (Gr. *ectopus*, out of place). Condition in which the fertilised ovum, or egg cell, instead of developing within the uterus, becomes implanted in the Fallopian tube which leads to the uterus, or escapes into the body cavity and there begins to develop. It is rare in young women, and is most often seen in women who have been married for a number of years without having had a child, or where a long time has elapsed since the last pregnancy. Any inflammation affecting the tubes is a predisposing cause, narrowing the lumen of the tube or interfering with the movements of the delicate cilia (minute processes of the lining mucous membrane) which with a wave-like movement normally propel the fertilised ovum towards the uterus.

The symptoms are not very definite, but some signs of pregnancy may be present. When irregular bleeding or recurring colic-like pains occur, coupled with the possibility of pregnancy, a medical opinion should be sought. Often, however, the first indication is a sudden attack of acute pain with collapse, and signs of internal haemorrhage, due to rupture of the sac of the developing embryo. In most cases immediate operative treatment provides the best hope of saving life.

Ectoplasm (Gr. *ektos*, outside; *plasma*, something moulded). The outer layer of a non-cellular animal, such as amoeba, and apparently usually in the gel state, i.e. relatively stiff. It can undergo a reversible thixotropic change to the sol condition in which it flows. It acts as a semi-permeable membrane and permits the ingress and egress of molecules during the metabolism of the animal. Spiritualists use the term ectoplasm for an apparent vaporous materialisation occurring during the trance of the medium.

Ectozoa (Gr. *ektos*, outside; *zōon*, animal). Term applied to parasites which live on the exterior of their hosts, in contrast with the entozoa, which live in the internal organs. Lice and ticks are examples of the ectozoa, tape worms and flukes of the entozoa.

Écu (Fr., shield; Lat. *scutum*). Obsolete French silver coin. First struck by Louis IX, its value was three livres. Charles VI issued, in 1384, a piece known as *écu de la couronne*, the *écu* being called in England a crown. There was also minted a double silver *écu* of six livres, worth about 5s. See Crown.

Ecuador. Republic of South America, lying between Colombia on the N. and Peru on the S. It is so named because the equatorial line runs through the country. Its western shores, 500 m. in extent, are washed by the Pacific Ocean. The Colombian boundary was settled by treaty in 1917, and the Peruvian frontier was agreed upon in Jan., 1942. The republic embraces the provinces of Azuay, Bolivar, Cañar, Carchi, Chimborazo, Cotopaxi, Esmeraldas, Guayas, Imbabura, Loja, Manabi, Napo, Pastaza, El Oro, Pichincha, Los Rios, Santiago Zamora, Tungurahua, and the Galápagos archipelago. Its area is not known even approximately; there are estimates of 176,000 and 276,000 sq. m. A large area was lost by the 1942 revision. The first census, 1950, strongly opposed in the Indian villages, gave a pop. of 3,202,757; 1955 est., 3,619,345.

The dominant geographical feature is the gigantic mountain system which traverses the land from N. to S. Two towering mountain ramparts, the Eastern and Western Cordilleras, run parallel to each other, enclosing a broad elevated valley, 20-50 m. wide, and



Ecuador. Map of the South American republic which lies between Colombia and Peru; the frontiers shown are those of the 1942 revision

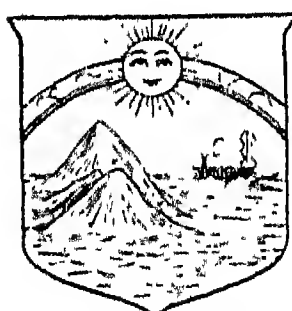
8,000-10,000 ft. above sea level. This trough is walled on either side by the famous "avenue of volcanoes," above a score of peaks in a double line, most of them rising far above the snow line. No fewer than 20 of these summits can be counted from Quito, the capital, which stands on the central plateau at a height of 8,400 ft. The volcano of Pichincha (about 15,700 ft.) is notable for its perilous proximity to the capital; but more conspicuous is the perfectly symmetrical and dazzling cone of Cotopaxi (19,500 ft.). Higher yet soars the imposing snow-clad mass of Chimborazo (20,700 ft.). Above the snows, volcanic craters emit their clouds and ashes. Eruptions have been frequent since records began with the coming of the Spaniards, and the whole region is subject to earthquake shocks. The region presents an endless variety of altitude and climate: torrid, forest-clad plains bordering the lower spurs; temperate, pleasant, and productive valleys; cool regions of the lofty plateau; páramos, or icy, wind-swept plains and slopes, approaching the limit of perpetual snow.

Although the mountains predominate, the greater part of Ecuador lies in the forest-clad plains which stretch to E. and W. from the foot of the two Cordilleras. In fact, Ecuador has three distinct zones: the coastal plain, the Andine mountain system, and the *montaña*, the densely wooded region stretching into the

interior from the base of the Eastern Cordillera, and intersected by the multitudinous upper waters of Amazonian affluents.

The most valuable and productive part of the country is the broad coastal plain, richly tropical and humid in character. This plain, watered by innumerable streams and originally covered by dense forests, supports the extensive plantations of cacao, which supply the chief export, besides plantations of bananas and other tropical products. Numerous streams, particularly those connected with the port of Guayaquil, provide access to the cacao plantations. The forest is valuable for its thickets of bamboo, dyewoods, cinchona, balsa trees, and many kinds of palms, besides the palm-like plant whose fibre is woven into Panama hats.

Through the towering wall of the Western Cordillera, lofty passes lead to the Andine plateau. From this plateau steep and difficult mountain passes lead eastwards, up between the peaks of the Eastern Cordillera, and then down along twisted and precipitous river valleys to the *montaña*, where scanty tribes of savage Indians support life by hunting with the blow-pipe and with poisoned arrows. This most inaccessible region resembles the forests of Brazil; its woods and waters are haunted by a multitude of reptiles, saurians, fishes, birds, and insects. Trees, lianas, flowering shrubs, and gaudy orchids occur. The mammals



Ecuador arms

include jaguars, pumas, tapirs, sloths, bears, deer, armadilloes.

The volcanic group of the Galápagos Islands lies on the Equator, 695 m. from the W. coast, and covers 2,868 sq. m. Named from the gigantic tortoise (galápagos) found on the islands, they are remarkable for the fact that about half the indigenous plants, all the reptiles, and nearly all the birds are peculiar to this archipelago. In the 17th and 18th centuries the islands, at that time uninhabited, were the resort of buccaneers.

PEOPLE, LANGUAGE, ETC. The population is descended partly from Spanish settlers, partly from indigenous Indians, and in a less degree from negro slaves. Most of the Indians and mixed types are simple and ignorant; they perform all the manual labour, and bear with customary apathetic submission the domination of the ruling class. These peasants and labourers are virtually devoid of any sense of nationality or citizenship and indifferent to forms or methods of government, although they have been swept into contending armies, in numerous civil wars, by *caudillos* on either side. More than 50 p.c. of the pop. is pure-blooded Indian, 25 p.c. mixed Spanish and Indian, 15 p.c. negro, and the remainder is of pure Spanish descent. The dominant class, which forms a society of typically S. American culture, is of mixed blood. The official language, and the tongue in general use, is Spanish. Quichua is spoken by several Indian tribes in the N.

CONSTITUTION, ETC. Under the constitution of March 6, 1945, the president is chosen by direct popular election for four years, and is eligible for re-election, but only after an interval of four years. A single chamber of deputies is chosen for two years by elections on a provincial basis, extra deputies being chosen by special groups. All literate men and women over 18 are eligible to vote. The Roman Catholic faith is generally professed, maintaining an archbishop and six bishops, but is not officially established; all religions are tolerated. Primary education is free and compulsory. There are universities at Quito, Guayaquil, and Cuenca. There is a small standing army, with compulsory military service. The unit of currency is the sucre.

ECONOMIC CONDITIONS, INDUSTRY, ETC. A large part of the world's supply of cacao comes from Ecuador. The weaving of Panama hats is an important industry;

nearly 3,000,000 are exported annually. The chief exports are cacao, coffee, rice, rubber, bananas, ivory nuts, balsa wood, hats, and a little kapok, mangrove bark, and alligator skins. Cotton is raised in Manabí and tobacco in Esmeraldas. Some gold is produced in the Andes. Deposits of petroleum occur in Guayas, some 300,000 tons, mostly crude, being exported annually; sulphur in Chimborazo and the archipelago.

Guayaquil, the chief port and the largest town in the republic, is linked with Quito by a mountain rly. 288 m. long, which traverses one pass of the Western Cordillera. There are eight other short lines. Main roads total 1,600 m., but over the greater part of the country bridle-paths and mules are the means of transport. Cuenca, Ambato, Riobamba, Loja, and Latacunga are other towns.

HISTORY. Before the European discovery of America, the mountain plateau was the seat of a monarchical native civilization, inferior to that of the Incas, but notable for its organization and skill in the arts of building, stone-carving, weaving, pottery, and the working of gold and silver. Towards the end of the 15th century the Inca monarch, Huayna Capac, defeated the king of Quito, and added his dominions to the Inca empire. By the daughter of the conquered chief, the Inca conqueror had a son, Atahualpa, who became the Inca ruler of Quito. He then claimed the throne of the Inca empire, and dethroned his brother, the legitimate heir. He himself lost his kingdom and his life at the hands of Pizarro, the Spanish invader, in 1533. The conquest of Peru by the Spaniard was naturally followed by the occupation of Quito. The kingdom of Quito, which included territory now belonging to Colombia, constituted thenceforth a presidency or government, subordinate to the Spanish viceroy of Peru. But in the 18th century the presidency of Quito was made subordinate to the newly established viceroyalty of Santa Fé de Bogotá.

In 1808 a revolutionary or republican movement broke out in Quito; but, after four years of confused tumult, Spanish authority was re-established, and subsisted until the decisive victory of the republican commander Sucre in the battle of Pichincha in 1822. Quito was now incorporated into the extensive republic or federation of Colombia under the authority of Bolívar. But in 1830 that rather artificial political system was

broken up into the three separate republics of Venezuela, New Granada (now Colombia), and Ecuador.

There followed a stormy period of personal rivalries, despotisms, factions, civil wars, frontier wars with Colombia, and boundary disputes with Peru. From 1859 to 1875 the country was ruled by García Moreno, an ultra-clerical conservative, who attempted to set up a kind of Catholic theocracy, to be guided by the authority of the pope. His dictatorship, more stable than previous governments, was by no means peaceful; and his assassination in 1875 opened a fresh era of disorder and conflict.

Ecuador began to benefit with the rest of South America by economic expansion in the 20th century, though its political temper remained erratic, few presidents completing their terms without the threat or practice of revolution. In foreign affairs the outstanding question was that of frontiers, especially with Peru, but the definitive settlement of 1942, after a period of open hostilities, seemed to promise a less strained atmosphere. Argentina, Brazil, and the U.S.A. assisted in the settlement. Ecuador broke off relations with Germany in the First Great War and was a signatory of the peace treaty. In the Second Great War she severed relations with the Axis powers, Jan. 31, 1942, allowed the U.S.A. to establish bases in the Galápagos Islands and the Santa Elena peninsula, and declared war on Germany and Japan Feb. 8, 1945.

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Ecumenical. See *Ecumenical*.
Eczema (Gr. *ek*, out; *zein*, to boil). An inflammatory disease of the skin. The term includes cases due to chemical irritants of which the nature is unknown; those in which individuals are over-susceptible to mild irritations, e.g. by sun or wind; and those which become hypersensitive to an irritant so that fresh patches are produced. Predisposing causes are certain toxic states such as gout or rheumatism; deficient elimination as in Bright's Disease; chronic septic absorption as in pyorrhea; while sensitiveness may be either inherited or acquired. Some disturbance of the nervous system may be present.

Eczema varies widely in type, stage, and distribution over the

body with the age and condition of the patient, but its essential characteristics are redness of the skin, formation of small blisters or vesicles, watery discharge, formation of crusts and scales, and usually extreme itching. Various types are recognized: erythematous eczema, in which bright red patches appear on the skin; papular eczema, characterised by the formation of small red papules or pimples about the size of a pin's head; vesicular eczema, marked by the appearance of crops of vesicles and watery discharge; and pustular eczema, in which pustules containing matter are formed and on rupturing give rise to yellowish-brown scabs.

Attention must be paid to the general health, sepsis being eliminated, and the liver eased of its burden by the removal of fats, pork, and milk from the diet. Alcohol and tobacco, because of their toxic influence, must be avoided. Many cases of eczema result from specific irritants; the offending substance can sometimes be determined by the reaction produced when it is introduced into the skin, a weal or blister being a positive result. Desensitisation can then often be achieved by injecting under the skin minute and gradually increasing doses of the material. This type of eczema has much in common with asthma and urticaria and the conditions are found in certain family groups (*see Allergy*). Local medical treatment depends entirely on the manifestation of the disease at the time.

Edam. Town of the Netherlands, in the province of North Holland. It lies twelve miles N.N.E. of Amsterdam. The name is derived from a dam built on the little stream Ye. Edam possesses some old brick houses, and a fine church, S. Nicholas, dating from the 14th century and restored, 1602-26. It is noted for its dairy produce, and in particular for round, red-rinded cheese (*v.i.*).

Edam Cheese. A Dutch cheese. It is pressed in globular moulds, red outside, a rich apricot inside. It is a cow's milk cheese, weighing about 5 lb. Texture is waxy, and flavour varies in quality. It is not usually considered a gourmet's cheese, but connoisseurs have been known to treat it like Stilton, even to the careful introduction of port wine. Gouda cheese is almost exactly similar, but is made in large flat rounds, and in two grades, one with 45 p.c. fat content, the other with 40 p.c.

Edda. Two collections of Icelandic literature, known respectively as the Elder, or poetical, of Saemund, and the Younger, or prose, of Snorri. The former were discovered by Brynjulf Sveinsson, an Icelandic bishop, in 1643. He attributed them to Saemund Sigfusson (1055-1132), but an earlier date is generally assigned by critics. The Prose Edda was compiled by Snorri Sturlason (1178-1241), and is generally ascribed to the 12th century.

Eddington, SIR ARTHUR STANLEY (1882-1944). A British astronomer and philosopher. Born



Sir A. S. Eddington,
British astronomer

at Kendal, Dec. 28, 1882, he was educated at Manchester university and at Trinity College, Cambridge, where he was senior wrangler in 1904 and fellow in 1907. As chief assistant from 1906 at the Royal Observatory, Greenwich, he established his reputation as a brilliant worker in stellar mathematics. He became Plumian professor of astronomy at Cambridge in 1913, and the next year was appointed director of the university observatory and elected F.R.S. In 1928 he was awarded the Royal Medal of the Royal Society, and in 1930-32 was president of the Physical Society. He was knighted in 1930 and invested with the O.M. in 1938. He died Nov. 22, 1944.

Eddington's principal researches were concerned with stellar motions, in which field he first established that the stars describe orbits under the attraction of the whole galaxy without interfering with one another; with the theory of relativity, which he helped to confirm at the eclipse of the sun in 1919; and with the internal constitution of the stars, in which he first established the importance of radiation within a star and discovered that its brightness depends essentially on its mass. From 1925 he entered the field of philosophy, concluding that much of physics is deducible by pure reason. In *The Expanding Universe*, 1933, he gave expression to a theory described under *Expansion of the Universe*. He was known to the public through lucid expositions of scientific topics: *Report on the Relativity Theory of Gravitation*, 1918; *Space, Time and Gravitation*, 1920; *The Mathematical Theory of Relativity*, 1923; *Stars and Atoms*, 1927;

The Nature of the Physical World, 1928; *Science and the Unseen World*, 1929; *New Pathways in Science*, 1935; *Fundamental Theory*, 1947.

Eddo. Tuberous stem of several species of colocasia, caladium, etc., of the family Araceae. Though acrid in a raw state, these stems are used as food when cooked. *Colocasia antiquorum*, an E. Indian species, is cultivated for food, even in S. Europe, under the name of taro (*q.v.*).

Eddy, MARY BAKER (1821-1910). An American religious leader, the founder of Christian Science. She was born at Bow, New Hampshire, July 16, 1821. Deeply religious by nature, she was from childhood a Bible student. Asa Eddy (d. 1882), whom she married in 1877, was her third husband; she had been widowed, and obtained a divorce. She died at Newton, Mass., Dec. 3, 1910.

It was in 1866, while recovering from the effects of an accident—her recovery she attributed to the reading of Matt. 9, vv. 2-8—that she discovered in the Bible a scientific law underlying the healing works of Christ. She named her discovery Christian Science, and in 1875 issued its textbook, *Science and Health with Key to the Scriptures*. Other writings by Mrs. Eddy include: *Unity of Good*; *No and Yes*; *Rudimental Divine Science*; *Pulpit and Press*; *Retrospection and Introspection*; *Christian Healing*; *The People's Idea of God*; *Messages to the Mother Church*; *The First Church of Christ, Scientist, and Miscellany*; *Christ and Christmas*; *Christian Science versus Pantheism*. Her biographers are E. F. Dakin, 1929; L. Powell, 1930; S. Wilbur, new ed., 1930. *See Christian Science*.



Mary Baker Eddy,
Christian Scientist

Eddystone. Lighthouse on the Eddystone Rocks, a dangerous reef, 14 m. S.W. of Plymouth. There have been four. The first, of wood, 120 ft. high, by Winstanley, was destroyed with its builder by hurricane and fire in Nov., 1703, three years after its completion. The second, 92 ft. high, was erected by John Rudyard in 1709, and was burned down in 1755. The third, a granite building by Smeaton, 95 ft. high, was completed in 1759. It was the first in which the stones were dove-



Eddystone Lighthouse, built 1882.
Left, stump of the old lighthouse

tail jointed, and remained a model for other designs till 1877, when it was found necessary to dismantle it, as the rock foundation had become insecure; the upper sections being transferred to Plymouth Hoe. The present tower, completed in 1882, is located 40 yards from the previous one. Built of granite, with dovetailed stones, it is 168 ft. above low water and is built in circular sections. The lantern shows a group flashing light of two flashes every 30 secs., and has a range of nearly 18 m.

Ede, JAMES CHUTER (b. 1882). British politician. He was born at Epsom, Sept. 11, 1882, and



J. Chuter Ede,
British politician

educated at Dorking high school and Christ's College, Cambridge. He taught in Surrey schools before entering civic life and was chairman of the Surrey county council, 1933-37. He entered parliament in 1923 as Labour member for Mitcham; and represented South Shields, 1929-31, and from 1935. Ede was parliamentary secretary to the ministry of Education in 1940, and Home secretary in C. R. Attlee's cabinet of 1945. He was made a P.C. in 1944, C.H. in 1953.

Edelfelt, ALBERT GUSTAF ARISTIDE (1854-1905). Finnish painter. Born at Helsinki, July 21, 1854, he was trained at Antwerp and at the École des Beaux Arts, Paris, under Gérôme. He painted landscapes, portraits, and compositions with equal skill. Invited by Tsar Alexander III to paint the portraits of his children, he produced, while in Russia, several works in landscape and genre. He died at Borga, Aug. 18, 1905. His finest and most characteristic works are

Divine Service in the Skaergaard, at the Luxembourg; Pasteur in his Laboratory, at the Sorbonne; Laundry; Jesus appearing to Mary Magdalen, and Women in the Churchyard, both at Helsinki.

Edelinck, GÉRARD (1640-1707). Flemish engraver. Born at Antwerp, Oct. 20, 1640, he was the pupil of Gaspard Huberti and Cornelis Galle. Visiting Paris in 1665, on the invitation of Colbert, he practised there for the rest of his life, and is more properly classed with the French school. He obtained ample patronage from Louis XIV, was received in the Academy in 1677, and died in Paris, April 2, 1707. He became one of the most brilliant line engravers of the 17th century. In portraiture—e.g. his Dryden and Philippe de Champaigne—Edelinck was equally accomplished.

Edelweiss (*Leontopodium alpinum*). Perennial herb of the family Compositae. A native of the mountains of S. Europe, and Himalaya, it is thickly coated with long woolly hairs, which give it a white appearance, accentuated in the bracts which surround the cluster of terminal yellowish flowerheads. The leaves are lance-shaped, and the plant is about 6 ins. high. It occurs locally in the Alps, but the idea that it is exceedingly rare and can only be gathered in circumstances of great danger is erroneous. Edelweiss is German, meaning "noble white."

Eden. English river rising on the borders of Westmorland and Yorkshire, and flowing N.W. past Kirkby Stephen and Appleby into Cumberland, and then past Carlisle to the Solway Firth, which it enters at Rockliff. Its length is 65 m., and it contains salmon. A stream of the same name is a tributary of the Medway, in Kent.

Eden. River of Fife, Scotland. It is formed by the confluence of two small burns, the Beattie and the Carmore, at the Kinross-shire border, and flows E.N.E. through the Howe of Fife and past Cupar to the North Sea, which it enters at Guard Bridge by a muddy estuary 6 m. in length; total length 30 m. There is good salmon fishing.

Eden, GARDEN OF. In the earliest Biblical account (the Jahwis-

tic) of Creation (Gen. 2, vv. 8-25) Yahweh Elohim plants a garden eastward (from the Palestinian standpoint) in Eden for man to dwell in. In the Septuagint the word for garden, Heb. *gan*, is represented by *paradeisos*, a loan-word (Hebraised *parlēs*) from the Zend *pairi-dāza*, "enclosure"; hence arises the term Paradise as a description of Eden and of the Christian heaven. The garden of Eden seems to have been thought of as a park or pleasure-ground; in Gen. 3, v. 8, Yahweh Elohim is described as walking in the garden in the cool of the evening (cf. Isaiah 51; Ezek. 28 and 31). The name Eden is perhaps from Babylonian *ēdinu*, plain or steppe, more probably from Hebrew *ēden*, delight.

The location of Eden is difficult to determine. Sayce identifies the garden with the sacred garden of the Babylonian deity Ea at Eridu, the river which watered it (Gen. 2, v. 10) being the Persian Gulf, and the four branches (vv. 11-14) being the

Pallakopas, the Choaspes, the Tigris, and the Euphrates. E. Naville (Archaeology of the O.T., 1913), comparing Gen. 13, v. 10, "like the garden of the Lord, like the land of Egypt as thou goest unto Zoar," and identifying Zoar with the Egyptian Zar (mod. Kantarah), thinks that the narrator located the garden in Egypt in the western part of the Delta

between the Tanitic and Pelusiac branches. Another traditional site is at Kurna at the junction of the Euphrates and the Tigris, and an old tree preserved here, claimed as the original Tree of Knowledge, was broken by British soldiers in 1920, and re-erected on a concrete base. It is not, however, of any great age. See Creation Legends; Fall.

Eden, SIR (ROBERT) ANTHONY (b. 1897). British politician. Second son of Sir William Eden, he was born June 12, 1897, and educated at Eton and Christ Church, Oxford. Entering parliament as Conservative member for Warwick and Leamington in 1923, he was private secretary to Sir A. Chamberlain during the latter's foreign secretaryship, 1926-29. Made under-secretary for Foreign Affairs in 1931, he was lord privy seal three years later



Edelweiss. Specimen of the plant on a mountain side

and during this period still devoted much attention to foreign affairs, especially to the League of Nations. In the Baldwin cabinet



Sir Anthony Eden,
British politician

of 1935 he was minister without portfolio for League affairs, and his adroit handling of diplomatic situations led to his appointment as Foreign secretary in succession to Sir S. Hoare

on Dec. 23. He resigned in Feb., 1938, as a result of his disagreement with Neville Chamberlain's policy towards Mussolini and Hitler.

On the outbreak of the Second Great War one of the changes by which Chamberlain broadened his Conservative administration was bringing Eden back to office as Dominions secretary. When Churchill became prime minister in May, 1940, he made Eden War secretary, a position he retained until, again on Dec. 23, he succeeded Lord Halifax as Foreign secretary. In 1943 he visited the U.S.A., where he conferred with President Roosevelt and other leaders. He visited Athens several times during the winter of 1944-45, alone and in company with Churchill, for discussions on Greek affairs. He was head of the British delegation to the San Francisco conference, 1945. He retained his post in Churchill's "caretaker" government, May-July, 1945, and when Churchill took office again in 1951, he was reappointed Foreign secretary. Made K.G. 1954, he was premier 1955-56, resigning after the Suez Canal (*q.v.*) crisis on account of ill health.

Edenbridge. Market town of Kent, England. It stands on the Eden, 25 m. S.S.E. of London by railway. There are some ancient houses and a church in several styles from Norman onwards with a Burne-Jones window. The town is a centre for neighbouring agriculture. Its annual firework display on Nov. 5 is well known. Pop. 3,500.

Edenhall. Parish and village of Cumberland, England. It stands on the Eden, 3 m. N.E. of Penrith. At Eden Hall, former seat of the Musgraves, was an ancient enamelled drinking goblet, known as the Luck of Eden Hall, which, according to tradition, was taken from the king of a fairy band feasting near S. Outhbert's Well in

the grounds, who, when departing, exclaimed:

If e'er this cup shall break or fall,
Farewell the luck of Eden Hall.

This goblet was removed to the Bank of England. In Longfellow's translation of Uhland's ballad on the Luck of Eden Hall the glass is represented as having been destroyed.

Edentata (Lat. *edentatus*, toothless). Group of mammals without front teeth, and sometimes without cheek teeth also. They comprise the sloths, ant-eaters, and armadillos, all of which are S. American. The pangolins and the aard-vark are included in the order. Where cheek teeth are present in the edentates, they are of simple structure, have no enamel, are without roots, and continue to grow throughout life. All the genera are land animals, and while the sloths and some ant-eaters live in the trees, the armadillos are burrowing animals. They are insectivorous, except the sloths, which are vegetable feeders.

The living representatives of this order are insignificant in number and degenerate in structure compared with those found in a fossil state. Fossil skeletons are found in the Pampa formation of S. America. See Mammals.

Eden Treaty. Name sometimes given to the commercial treaty negotiated by Pitt and signed Sept., 1786, by William Eden (later Lord Auckland) for Great Britain and Count Vergennes for France. It removed several restrictions on trading between the two countries, but its effect was nullified by war in 1793 following the French Revolution.

Eder Dam. Dam on the river Eder, a tributary of the Weser, Germany. On May 17, 1943, Lancasters of the R.A.F., carrying special mines, attacked the Möhne,

Sorpe, and Eder dams. The Eder was breached in two places on its upstream face by mines dropped from aircraft at less than 100 ft. The dam, a curved, gravity concrete structure, 157 ft. high and 1,312 ft. long, was built in 1914, and the reservoir, the second largest in Germany, contained 200,000,000 tons of water. The dam compensated the Weser for water taken from it for the Midland canal, the link between all main navigable rivers W. of Berlin. Without the dam either the canal or the Weser would become unnavigable. After its destruction the water swamped vast areas and flooded factories, power stations, and towns, Cassel 35 m. away, being inundated.

Edessa. Ancient city in N.W. Mesopotamia, 40 m. E. of the Euphrates on the river Scirtos (Daisan). The Seleucid monarchs established a colony here which subsequently became the capital of Osrhoenē, an independent buffer state between Parthia and Rome, under rulers called by the title abgar. Taken over by Rome in 215, Edessa became one of the chief eastern frontier fortresses of the Roman and, later, the Byzantine Empire. A Christian community grew up in the 2nd century, and the city was a centre of learning and of Syriac Christianity. It fell to Islam in 638, was fought over in the Crusades, and taken by Saladin in 1182. Modern Urfa, Turkey, is on its site.

Edessa, Greece, is capital of Pella nome. Pop. (1951) 15,415.

Edfû or Atbo. Town of Egypt, on the left bank of the Nile, 485 m. S.S.E. of Cairo; the Greek Apollinopolis Magna. It is celebrated for its beautiful and almost perfect temple dedicated to Horus, one of the finest and best preserved Ptolemaic buildings. Its wall inscriptions are an important source of knowledge of Egyptian myth and ritual.

Edgar OR EADGAR (944-75). King of the English. The younger son of King Edmund, he became king as the result of a rising against his brother Edwy. The brothers were not apparently hostile to each other, but one party wanted Edgar for king and the witan decided that he should rule the land north of the Thames. In 959 Edwy died and Edgar became king of the whole country. His coronation, which did not take place until May, 973, is important in the history of that ceremony, in that, for the first time, the two archbishops took part. After this the king sailed to Chester



Edenhall. Drinking goblet known as the Luck of Eden Hall, with its case

From a drawing by G. G. Harper

and on the Dee was rowed by six or eight vassal kings. He assumed a certain vague overlordship, his authority extending to Ireland, and called himself emperor. He fought against the Welsh, but his reign rightly earned for him the title of the peaceful. He formed a fleet for service against the pirates, and showed zeal in putting down crime. With S. Dunstan he re-organized the monasteries. Edgar died July 8, 975, and was buried at Glastonbury. His son Edward, called the Martyr, succeeded to the throne.

Edgar Atheling (d. c. 1130). English prince. The son of Edward the Exile and grandson of Edmund Ironside, he was born in Hungary, but was brought to England in infancy. After Harold's death in 1066 he was proclaimed king by the northern earls, and in 1068 and 1069 was involved in unsuccessful rebellions in the N. of England. Reconciled to William the Conqueror in 1074, he lived at his court in Normandy for twelve years. In 1097 he deposed the Scottish usurper Donald Bane and seated his own nephew Edgar on the throne. He went on crusade in 1099 and in 1106 was taken prisoner at the battle of Tenchebrai while fighting for Robert of Normandy against Henry I. He was released, but the rest of his life was spent in obscurity.

Edgbaston. Suburb of Birmingham, England, giving its name to one of Birmingham's bor. constituencies. Almost entirely residential, it includes the Oratory of S. Philip Neri (1847), and the city cricket ground on which Warwickshire C.C. play matches. Neville Chamberlain was Conservative M.P. from 1929 until his death in 1940.

Edge, SELWYN FRANCIS (1868-1940). British motoring pioneer and agriculturist. Born in Sydney, N.S.W., March 29, 1868, he was brought to England as a child and privately educated at Norwood. He became one of the best cyclists of his time, and rode from London to York in 12 hours 50 mins. An early motor manufacturer, in 1896 he founded the De Dion Bouton business in England. In 1899 he established the Motor Power Company and was later connected with the Napier Company. He won the Gordon Bennett International Paris-Vienna race in 1902, the Harmsworth motor boat trophy, and for 17 years held the record of 1,581 miles for continuous 24-hour driving. Retiring in 1912, he took up farming. In 1917 he was con-

troller of the agricultural machinery department of the ministry of Munitions. Edge established the largest pedigree pig-breeding business in Great Britain and introduced the farm tractor. In 1921 he returned to the motor industry as director of A.C. Cars Ltd. He died Feb. 12, 1940.

Edgehill, BATTLE OF. First battle of the Civil War, fought between Charles I and the parliamentarians, Oct. 23, 1642. The hill is a ridge in Warwickshire, on the borders of Oxfordshire. The king was marching from Shrewsbury to London, and the parliamentarians, under Essex, moved across to intercept him. On the morning of the 23rd Essex marched out of Kington to find the royalists drawn up on Edgehill, about 3 m. away. His artillery had not yet arrived, so he left the initiative to his enemies, who opened the fight.

Each army was drawn up with the infantry in the centre and cavalry on the wings. On both wings the royalist horse, one body under Prince Rupert, the other under Wilmot, drove the parliamentarians before them and followed them for miles. In the centre the parliamentarians stood firm and only the return of Rupert's following and the oncoming night saved Charles from utter defeat. Charles had about 14,000 men; Essex about 10,000. A memorial on the battlefield was unveiled in 1949.

Edgeworth, MARIA (1767-1849). British novelist. Born at Black Bourton, Oxon, Jan. 1, 1767, she was one of many children of Richard Lovell Edgeworth, whom she accompanied to Ireland in 1773. She spent most of



Maria Edgeworth

her life on her father's estate at Edgeworthstown, obtaining her knowledge of the Irish peasantry from dealing with his tenants and her familiarity with fashionable life from association with his neighbours. She wrote *Practical Education*, 2 vols. (1798), in collaboration with her father, and it was largely on his account that she rejected a proposal of marriage made to her by Count Edlerantz, a Swede, at Paris, in 1802.

Visits to London and the Continent between 1803 and 1844 brought her into touch with the

best literary and fashionable society of her time, and in 1823 she visited Scott at Abbotsford, a visit returned by him at Edgeworthstown two years later. Scott's admiration of her literary ability is recorded in *Waverley*, where he declared that her presentation of Irish life and character had induced him to attempt a like service to his people in *The Waverley Novels*. In addition to the three novels of Irish life on which her fame is based *Castle Rackrent*, 1800; *The Absentee*, 1812; *Ormond*, 1817—she wrote *The Parent's Assistant*, 1796, enlarged ed. 1800; *Moral Tales for Young People*, 1801; and completed her father's *Memoirs*, 1820. The amiable and practical qualities displayed in her life distinguish Maria Edgeworth's books, which despite their didacticism still make a strong human appeal. She died May 22, 1849.

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Edgeworth, RICHARD LOVELL (1744-1817). British author. Born at Bath, May 31, 1744, he belonged to the English family that made their home at Edgeworthstown, co. Longford. Educated at Drogheda and Longford, he went to Trinity College, Dublin, and then to Oxford. Of independent means, Edgeworth was able to devote his time to study, friendship, travel, and experiment. He invented a system of telegraphy, was an early believer in the possibility of electricity, and helped to found the Royal Irish Academy. From 1772 until his death, June 13, 1817, most of his time was spent in Ireland, looking after his estates. For a short time he sat in the Irish parliament. His works include *Practical Education*, 1798, and *Memoirs*, parts of both being written by his daughter Maria (v.s.).

Edging Plants. Plants suitable for planting to make an edge to beds and borders. For sunny places the best of the perennial kinds are thrift (*armeria*), aubrietia, mauve catmint (*nepeta*), pink and silvery saxifrage. The old white, sweetly-scented pink named Mrs. Sinkins, and the Cheddar pink (*Dianthus caesiua*), are favourites for this purpose, but the newer Allwoodii pinks of various colours are often chosen. These plants need well drained soil; sand should be added to clay ground, and pinks and saxifrages

need a scattering of lime. All except thrift and saxifrage should be cut back when the flowers have faded. As edgings to shady borders, London Pride (*Saxifraga umbrosa*) and the bellflower named *Campanula muralis* are first-rate. Box is suitable as an edging to formal beds intersected by gravel paths; so, too, is lavender-cotton (*Santolina*) which forms small, grey-leaved bushes that should be pruned hard in spring.

Of annuals the most suitable are the dwarf white and lilac-coloured alyssum, candytuft, Virginian stock, leptosiphon, and dwarf nasturtium.

Edgren, ANN CHARLOTTE LEFFLER, DUCHESS OF CAJANELLO (1849-92). Swedish novelist and dramatist. The daughter of Prof. Leffler, a mathematician, she was born near Stockholm, Oct. 1, 1849, and married G. Edgren in 1872. Her earlier tales were issued under the pen-name of Carlot, but in 1882 she began a series of novels and plays under her own name, and many of these enjoyed considerable success. One of the plays, *Sanna Kvinnor*, 1883, was translated into English by H. L. Braekstad as *True Women*, 1890. In 1890 she married the Italian mathematician, the duke of Cajanello. She died at Naples, Oct. 21, 1892.

Edgware. Residential town of Middlesex, England. It is 8½ m. N.W. of Marble Arch, on the road to St. Albans, and is served by London Transport road and rail. Formerly called Eggesware and Edgworth, and once the first village of note on Watling Street after its emergence from London, its manor has been since 1443 the property of All Souls College, Oxford. The W. side is in the parish of Little Stanmore. The parish church of St. Margaret, rebuilt 1765 and 1845, is said to have been part of a monastery; near it was a house of refreshment for the monks of St. Albans as they travelled to and from London. Of the old inns, The Chandos Arms has a fireplace from the mansion of Canons (q.v.).

At Edgware was the forge of William Powell, whose work on the anvil is said to have suggested to Handel the melody of *The Harmonious Blacksmith*. Piper's Green preserves the tradition that a former lord of the manor provided a minstrel for the amusement of the tenants in his service. Brockley Hill, 1 m. farther N., is supposed to be the site of the Roman station *Sul-loniaca*.

Edible Birds' Nests. Nests of certain species of swift (*Collocalia*), found in Australia and the East Indies. They are composed chiefly of the saliva of the birds and are attached to the walls of caverns. The Chinese value them as a delicacy and convert them into a kind of glutinous, but almost tasteless, soup.

Edict (Lat. *edictum*). Promulgation, on his entry upon office, by a Roman magistrate, especially a

praetor, of the principles upon which he intended to administer the law during his term. The result of this practice was that side by side with the civil law there grew up a great body of magisterial law which ultimately became the most valuable part of Roman jurisprudence. The word was also used later, especially in France, for certain laws, e.g. the edict of Nantes. See Praetor; Roman Law.

EDINBURGH: THE CITY AND ITS HISTORY

Sir William Young Darling and Sir Herbert Maxwell, Bart.

One of Edinburgh's leading citizens, a former Lord Provost who later became M.P. for South Edinburgh, describes the Scottish capital as it is today; its romantic history is told by a distinguished Scottish historian and former chairman of the National Library of Scotland. See also Arthur's Seat; Canongate; Fettes College; Holyrood; Princes Street, etc.



Edinburgh city arms

Edinburgh is the capital of Scotland and is the headquarters of the administration of Scottish affairs. At S. Andrew's House in the city (built in 1539 by Thomas S. Tait) there is housed the secretary of state for Scotland, who is responsible for education, agriculture, health (which includes housing), and what is called the Scottish home department. The other departments of the United Kingdom are administered in Scotland directly by the minister at Whitehall, but always in association with the secretary of state for Scotland, although in the house of commons responsibility is accepted by the specific minister, except for the foregoing four departments under the secretary of state.

The law courts—the court of session and the high court of judicary—are located in Parliament Square, while at Register House, opposite the General Post Office, are to be found the various records and register offices, including the office of the Lord Lyon court. Thus, Edinburgh is not only an historic capital but an administrative capital.

The population of the city at the census of 1951 was 466,770 (1931, 439,010); there were many fluctuations during the Second Great War. Edinburgh is one of the largest cities in the United Kingdom in extent: it measures 11½ m. by 8 m. and is one of the earliest of the planned cities of the world. It comprises seven burgh constituencies.

The Royal Mile, in The Old Town, as it is called, is what re-

mains of the city's earlier days and in its historic houses, ranging between the castle (including the national war memorial) and the palace of Holyroodhouse, the nobility and gentry of the days gone by lived. At the beginning of the 19th century the town's boundaries extended, and what is still called The New Town came into being under the inspiration of the Adam brothers. Here, in Princes Street, George Street, Queen Street, Heriot Row, Northumberland Street, and a succession of parallel streets and squares, is to be found one of the best examples of planning in the kingdom, and these broad highways are a lasting memorial to a generation which had a wide conception of the best in city life.

The city of Edinburgh is grouped round the centre of Scottish government; but it has an industrial life independent and entirely its own. Its chamber of commerce was instituted by royal charter in 1786. For generations it has been a brewing centre. Unique wells rising from its unusual geological strata form the basis of this important and widespread industry. Its other activities include the making of textiles, particularly in the field of knitted wear, engineering in all its aspects—and, very notably, light engineering and electrical engineering—shipbuilding and ship repairing in the port of Leith, granted to the burgh of Edinburgh by Robert I in 1320, and the manufacture of rubber, an industry which includes the largest employer of female labour in Scotland.

Edinburgh University (v.i.) is the pioneer educational institution of the city. Closely associated with it are the medical schools and hospitals and, in another field, such

colleges as the Heriot Watt college (specialising in technical education), and the Edinburgh college of art, which has a notable record in the field of architecture and town planning.

The schools of Edinburgh, too, are of marked importance. Under many public trusts, notably the company of merchants of the city of Edinburgh, several famous schools are maintained by the generous endowments of days gone by. The best known of these, perhaps, is George Watson's college, at which have been educated chancellors of the exchequer and other ministers of the crown; Daniel Stewart's college; Edinburgh Academy (*v.i.*), at which Lord Cunningham was educated; Fettes college, founded by an Edinburgh grocer and former lord provost of the city, a residential school which attracts pupils from all over the country and includes Lord Simon among its notable scholars; the Royal high school, associated with Sir Walter Scott; Heriot's hospital, whose founder was banker to James VI of Scotland (afterwards James I of England); the Mary Erskine schools for girls; and George Watson's ladies' college. These famous educational establishments charge for education. Excellent schools are also provided under the education committee of the local authority within the boundaries of the city of Edinburgh.

Centre of Book Production

Edinburgh is among the great printing centres of the world and the making of books in all its aspects is a major preoccupation of a city which rests upon a wide and diverse cultural basis. Ancillary to the book producing industry, and of considerable importance, are the manufacture of printing machinery and printing inks, bookbinding and book illustration.

The government of the city of Edinburgh is under its town council, which consists of seventy-one members with a lord provost, who is entitled to the designation right honourable, bailies, a city treasurer, a lord dean of guild, and councillors. Its administration covers all civic activities and it has its administration grouped round the several departments. The town clerk and the city chamberlain are, respectively, the principal officers in the legal and financial spheres, supported by the burgh engineer, the medical officer of health, the city architect, the chief education officer and others. After the Second Great War an important new activity was under-

taken in the organization of the annual Edinburgh Festival (*q.v.*), which attracted visitors from all over the world.

The city is known for economical management and for many years the rating burden was maintained at under 10s. (in 1955-56 it was 14s. 10d.). The economy and efficiency of its administration has made Edinburgh a place which people, from home and abroad, tend to select as the place of their retirement, more especially if they have a family to educate.

The plan of the city of Edinburgh is unique and it owes, possibly, as much to nature as it does to art. It lies in a semi-circle of hills—from Corstorphine Hill (home of Edinburgh's far famed zoological park), the Pentland Hills, Arthur's Seat and the Salisbury Crags to the Calton Hill (with its observatory) and the fringes of the Forth. A beautiful and romantic city, it has evoked praise from writers of every nation and facing the spacious Princes Street are the celebrated Princes Street gardens, with a distinctive floral clock and many monuments.

Principal Public Buildings

The taste of its citizens is reflected in many buildings, public and private, of importance. The Usher Hall, presented by a generous Edinburgh citizen, the McEwan Hall, which owes its existence to a like generosity, the City Chambers, the National Gallery, the Antiquarian and the Royal Scottish Museums, the Bank of Scotland on the Mound and other head offices of great banks, St. George's parish church, the cathedral of St. Giles, and the much more recent episcopal cathedral of St. Mary in the west end of the city; these are only a few of the buildings well worth seeing for their individual quality. Combined, they make Edinburgh a city of character and distinction where the old blends with the new, and the whole produces a feeling of unity and satisfaction.

The city is diversified by many parks and gardens. The Links at Bruntsfield, Leith Links down by the water side, the golf courses on the Braid Hills, at Craigentanny, and at Carrick Knowe, the private golf courses at Barnton, Swanston, Duddingston, and Liberton diversify the streets and thoroughfares; the gardens in the squares lead on to the lovelier and more extensive Royal Botanical gardens at Inverleith; there are many bowling greens, tennis courts, playing fields and sports grounds of one

sort and another. Edinburgh has always had a strong appreciation of the importance of swimming and the many public baths include an open air pond at Portobello, completed in 1936.

Sir Walter Scott called Edinburgh "mine own romantic town"; Robert Louis Stevenson, dying in Samoa, sighed for "that long line of glittering gas lamps in Princes Street"; Robert Burns hailed the capital city as "Edina, Scotia's darling seat", and there have been lesser writers no less devoted to the city. Edinburgh is a communicative city and its citizens have an outward look. Successive lord provosts have been notable for their wide contacts, all over the world, particularly to the many centres where Scotsmen live and remember their capital city.

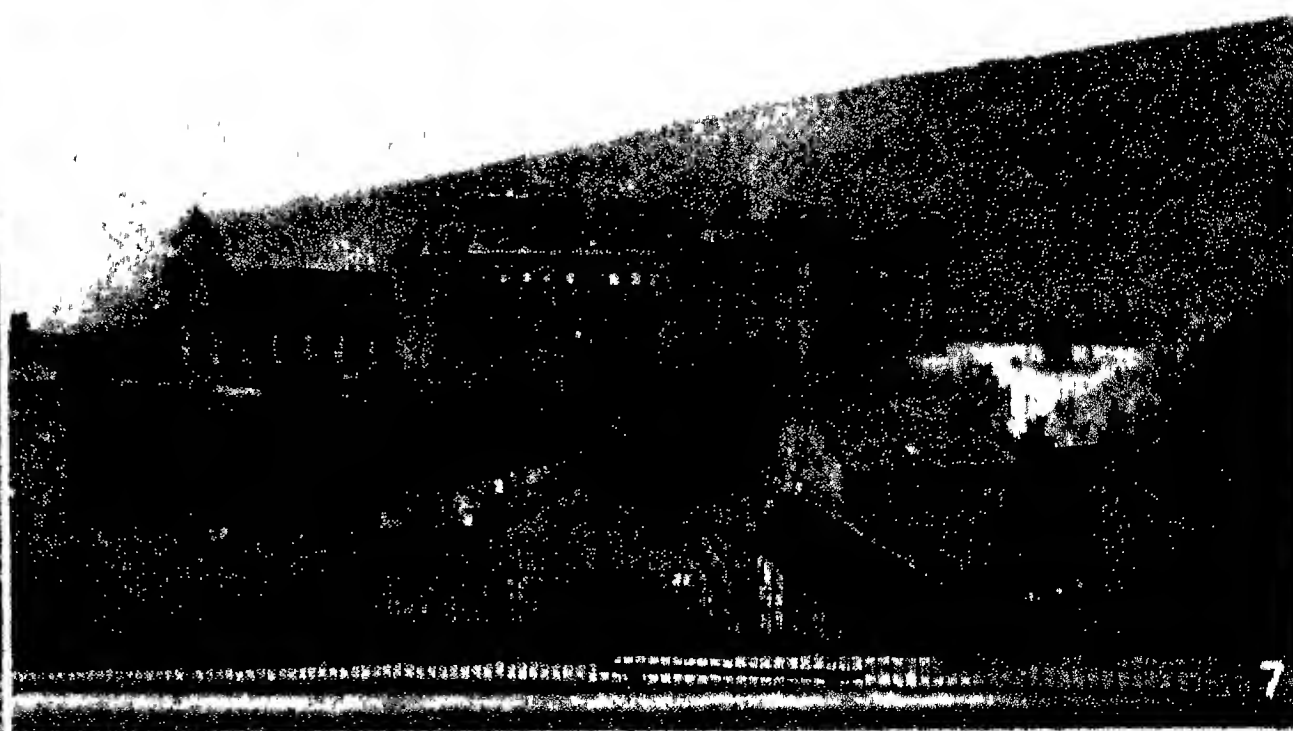
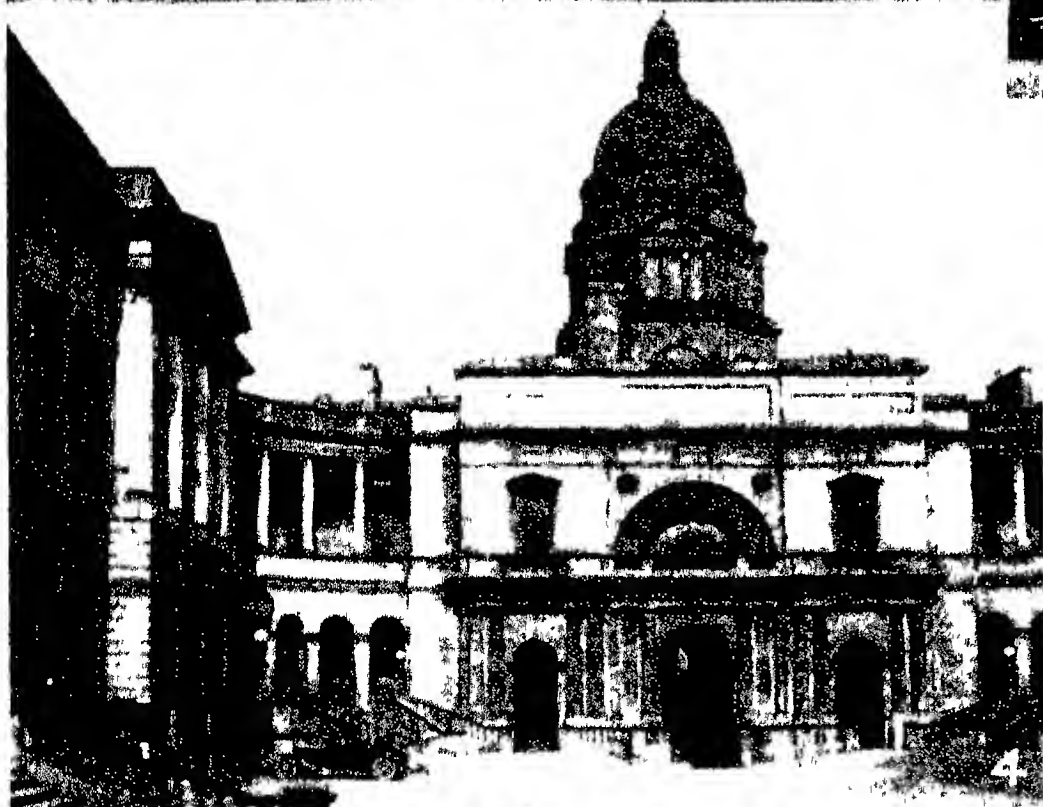
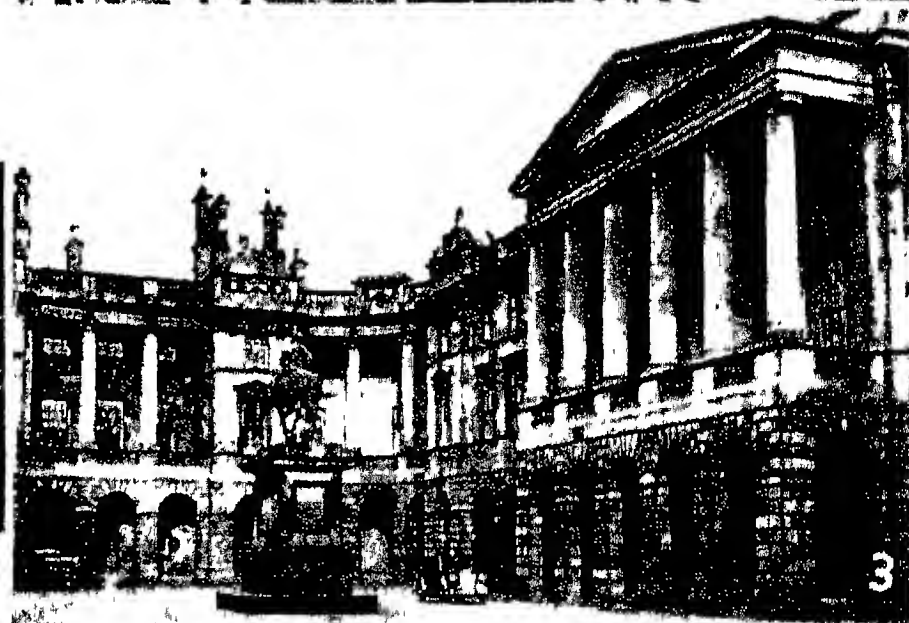
Transport and Communications

The city of Edinburgh has a special bureau for communications with the outer world, and the headquarters of the Scottish Tourist Board is located there. Edinburgh's roads date back to the very dawn of communications in Britain. Through it passed the Great North Road, as have passed through it the invading armies of the past and the fighting Scotsmen of yesterday. Edinburgh has two principal railway stations, the Waverley and the Caledonian. City transport is by publicly owned motor omnibus services (the tramway system was scrapped in 1956), supplemented by coach services which cover Scotland with Edinburgh as their centre. Turnhouse aerodrome is an important air station.

William Young Darling

History. In primitive times, when what is now Scotland was peopled by tribes chronically at war with each other, but combining on occasions against some powerful invader, isolated crags or mounts were highly esteemed for defensive purposes. Among numerous sites of that character in northern Britain, none stands out more conspicuous than the Castle Rock of Edinburgh, which would no doubt be seized by the early colonists of Lothian and fortified by the usual rampart of stone and palisade. Within the enclosure they planted their wattled huts, and subsisted by the chase; for according to Strabo (25 B.C.), and Dion Cassius (c. A.D. 150-235), the natives of northern Britain were ignorant or independent of agriculture when the Roman legions arrived there.

Of Edinburgh as a town, nothing



1. Princes Street : in the centre are the tall pinnacles of the Scott monument ; behind it, to the left, the colonnade of the National Gallery. Above, extreme left, is Castle Hill. 2. The Castle 3. Parliament House. 4. University buildings : the university was founded in 1583 by a charter of James VI. 5. West front of S. Giles's Cathedral. 6. House called John Knox's House. 7. Holyrood Palace : in the background, Arthur's Seat

EDINBURGH OLD AND NEW : PLACES OF NOTE IN SCOTLAND'S CAPITAL



Edinburgh. Map of the environs of the Scottish capital, including part of the Pentland Hills

appears, even in tradition, until after the conquest of Lothian by Eadwine, Saxon king of Deira (Yorkshire) and Northumbria, in the 7th century. It appears from King David's foundation charter of Holyrood in 1128, and Simeon of Durham's chronicle written in the same century, that King Eadwine was thus early regarded as the eponymus, for in both of these writings the place is called Edwines-burch. The Gaelic branch of the Celts called it Dunedin; among the Welsh population of Strathclyde it was known as Dineiddyn or Mynyddagneid, the latter name appearing to signify the mount of the Painted People or Picts. According to the Pictish Chronicle the Saxons held Oppidum Eden till they surrendered it to Indulf, son of Constantin king of Scots (954-962); but all is misty and vague until Malcolm III was persuaded by Queen Margaret to remove his seat of government from Dunfermline to Edinburgh, about 1060.

In 1128 David I founded the abbey of Holyrood, and empowered the convent to form the burgh of Canongate, which retained its separate jurisdiction until 1856, when it was united to the corporation of Edinburgh. The date of the erection of Edinburgh into a royal burgh is unknown. Doubtless it had already received a charter before David I (1124-53) made it his principal residence, but many years had to run before it was recognized as the capital of Scotland. The strategic importance of Edinburgh having been

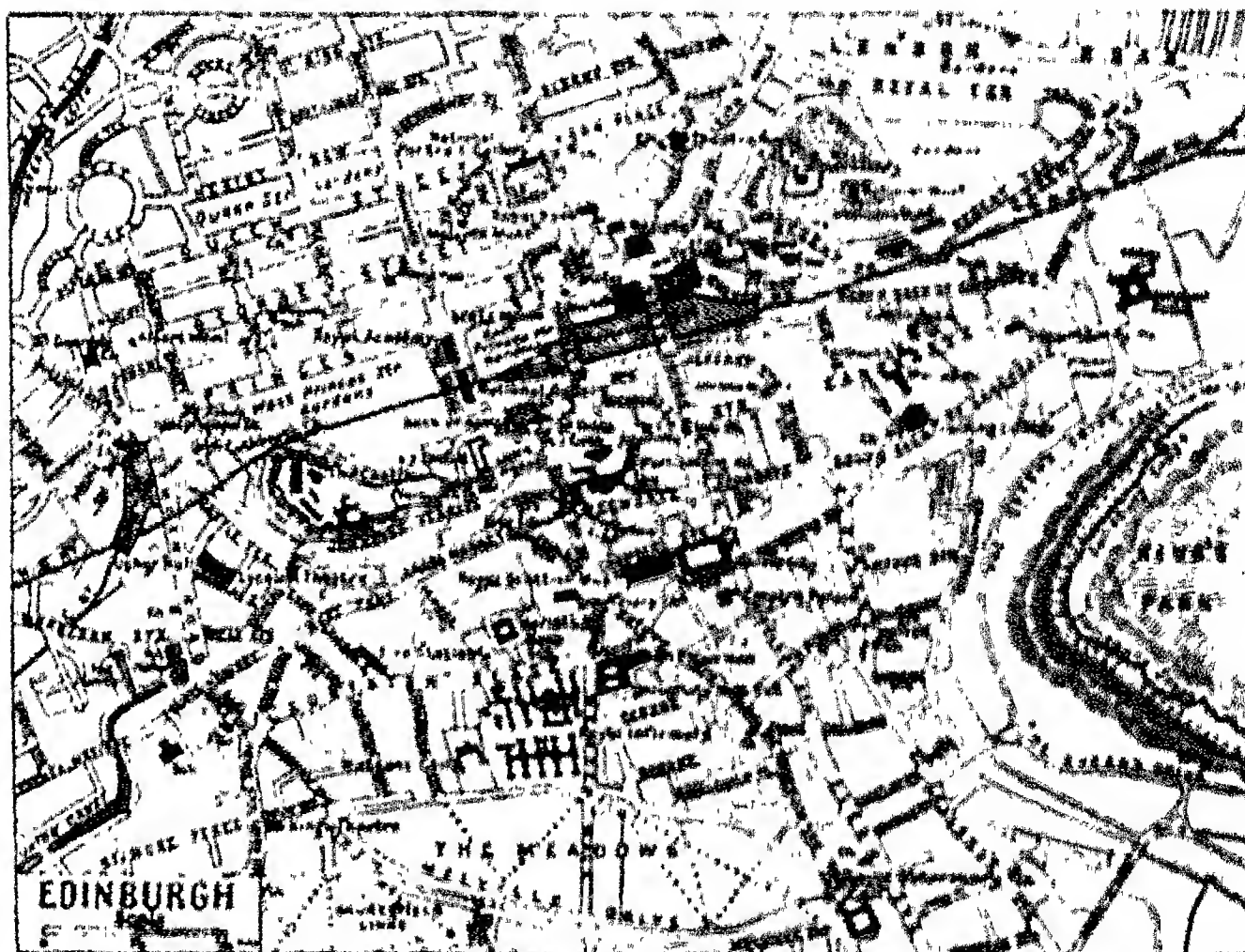
enhanced by the loss of Berwick in 1296 and Roxburgh in 1368, it became recognized as the most important town in Scotland, and increased steadily in population and commerce.

City and castle were taken by Edward III of England in 1335, but were recovered to the Scots by a clever stratagem in 1341. To the parliament summoned in 1357 for the special purpose of raising 100,000 marks for the ransom of David II, Edinburgh returned three burgesses, and appeared for the first time in precedence over all other burghs. It was sacked

and burnt by Richard II in 1385 and besieged by Henry IV in 1400, but the castle held out until Henry had to raise the siege in order to deal with Glendower's rebellion.

From this period onward Edinburgh, in common with the whole of Scotland, suffered from the arbitrary power of the great barons, who made full use for selfish ends of the opportunities afforded by the imprisonment in England of David II and James I, and by the frequency with which the succession to the throne devolved on an infant, the average age of seven successive sovereigns from 1406 to 1567 on their accession being but six years. Thus the 4th earl of Douglas, keeper of Edinburgh Castle, and a number of other nobles and officials, not only refused to pay the duties leviable upon wool and hides which they exported, but did not scruple to appropriate money which the customs officer had collected. In consequence, the gross customs of the city, which amounted to £2,047 in 1416, had fallen to £1,008 5s. 4d. in 1418, though the volume of trade was considerably greater. Bitter complaints of oppression were continually made to the government; Livingstone, guardian of the boy king James II, and Chancellor Crichton made these serve as excuse for ridding themselves of a dangerous rival, the 6th earl of Douglas, a lad of 17, whom, with his brother David, they lured to a banquet in Edinburgh Castle and had them both butchered in the king's presence.

In 1448 the town council, taking advantage of the respite of English invasion during the Wars of the



Edinburgh. Plan of the central part of the city. The valley spanned by the North Bridge separates the Old Town on the S. from the New Town on the N.

Roses, set to work to strengthen the defences of their city. The king's garden on the N. side, now occupied by the Waverley rly. station and lines, was inundated by a dam thrown across the E. end, thereby forming the North Loch, whence a wall was built round the E. and S. sides of the city to the Castle Rock near the West Bow.

During the reign of James IV (1488-1513) the revival of learning first made itself felt in Edinburgh. The guild of surgeon barbers received a royal charter in 1505, to develop under a fresh charter in 1686 into the Royal College of Surgeons of Edinburgh. In 1507 the first printing press in Scotland was established in Edinburgh. But a new era of bloodshed was inaugurated on Flodden Field in 1513, where James IV was killed with the flower of Scottish nobility and gentry. In 1544 the earl of Hertford sacked and burnt Edinburgh, wrecked Holyrood Abbey, drove away the monks, and gutted the palace, but was repulsed in attacking the castle. He returned in 1547 under his new name of Protector Somerset, and completed the destruction of Holyrood.

The Scottish Reformation

In the 16th century Edinburgh became the vortex of the Scottish Reformation. Parliament enacted the establishment of the Protestant religion in 1560, proscribing the Mass under penalty of death. Queen Mary, returning as a young widow to the capital which she had left as a child of six years, found the churches stripped of all adornment, the altars wrecked, the clergy, secular and regular, of her own faith banished, while from the pulpits Knox, Bruce, and other zealots hurled vehement denunciation against the Scarlet Woman. Knox laid the foundation of that system of national education to which Edinburgh owes so much of her distinction as a seat of learning and letters; but, dying in 1572, he did not live to see the foundation of the university in 1583.

Queen Mary's personal reign covered no more than six stormy years, perhaps the darkest and bloodiest in the whole history of Edinburgh. Conspicuous among the crimes perpetrated were the slaughter in Mary's presence of her favourite, David Rizzio, in 1566, and the murder of Darnley in 1567.

The city, which is believed to have contained at the time some 30,000 inhabitants, suffered considerably in trade when James VI succeeded to the throne of England and removed his court to London. He promised to revisit Edinburgh every third year, but fourteen

years went by before he returned for the first and last time. Charles I was crowned in Holyrood in 1633, eight years after his accession—the only coronation ever performed in the Scottish capital, except that of James II in 1437. In 1637 the city was thrown into ferment when Charles sent Laud's liturgy to Edinburgh, with a command that it was to be used in all the churches. Edinburgh had been staunchly loyal hitherto; but this gave immediate birth to the National Covenant which was signed in Greyfriars Churchyard, Feb. 28, 1638. The obnoxious liturgy was withdrawn, Sept. 17, but things had gone too far; the Covenanters were under arms, and in 1639 Sir Alexander Leslie, one of Gustavus Adolphus's veterans, stormed and captured Edinburgh Castle. After the pacification of Berwick, it was handed back in 1640 to Sir Patrick Ruthven, who also had served long under Gustavus Adolphus, for the king; but when war broke out afresh in June, it was captured once more by the Covenanters under Leslie.

In 1642, when King Charles took the field against his parliament, the people of Edinburgh were fervid Covenanters; but the Scottish privy council declared for the king by eleven votes to nine. On Aug. 2, 1643, the general assembly promulgated the Solemn League and Covenant, which sought to impose Presbyterianism by compulsion on both England and Scotland. Charles I having been executed Jan. 30, 1649, the Scottish Estates caused his son to be proclaimed king at the Mercat Cross of Edinburgh on Feb. 5, but the Covenanters would have none of him.

Covenanters and Anti-Jacobites

The duke of Hamilton, the earl of Huntly, and the marquess of Montrose were executed in succession in Edinburgh. Cromwell invaded Scotland, July 22, 1650, utterly defeated Leslie's Covenanters at Dunbar on Sept. 3, took possession of Edinburgh and proclaimed the Commonwealth. Ten years later, at the Restoration, "the Maiden," an instrument similar to the guillotine, was set to work at the Mercat Cross.

In 1688 the Edinburgh populace was vehemently anti-Jacobite. King James VII and II had escaped to France, but the mob overpowered the guard in Holyrood Palace; wrecked the abbey church, which had been redecored as the Chapel Royal, and, bursting open the royal burial place, scattered the bones of Scottish kings and queens. The duke of Gordon still held the castle for the king, and

his historic parting with Dundee, when that intrepid soldier rode from the Nether Bow to his death at Killiecrankie, forms the subject of Scott's lyric Bonnie Dundee.

The city was riotously convulsed during the proceedings in the Scottish parliament over the legislative union with England in 1707. It was little affected by the Jacobite rising of 1715, but in 1745 Prince Charles Edward, after defeating Sir John Cope at Prestonpans, took possession of Edinburgh, proclaimed his father king James VIII at the Mercat Cross, and held a brilliant court at Holyrood for more than two months.

Intellectual Edinburgh

Notwithstanding the loss of custom and prestige caused by the departure of James I and his court in 1603, the misery and bloodshed entailed by the civil wars and religious persecution of the 17th century, and the further loss consequent on the union of parliaments in 1707, Edinburgh continued to advance both materially and intellectually. Allan Ramsay the Elder, 1686-1758, who began life as a wig-maker, must be honoured as chief pioneer in the revival of literature, for he founded the literary coterie called the Select Society, reconstructed in 1755 as the Society for Encouraging Art, Science, and Industry. The torch which he kindled was passed from hand to hand by such writers as James Hamilton of Bangour, Thomson of The Seasons, David Hume the historian, John Home the tragedian, Dalrymple Lord Hailes, Home Lord Kames, Burnett Lord Monboddo, "Jupiter" Carlyle, Adam Smith, political economist, and Henry Mackenzie, the "Man of Feeling," who introduced Burns to Edinburgh society in 1787. These created a literary atmosphere which lingers in the Scottish capital to this day, having received fresh vigour from Jeffrey, Brougham, Lockhart, "Christopher North," and, most illustrious of all, Walter Scott.

Of social gaiety in Edinburgh there was no lack in the 18th century. Scotland had entered at the Union of 1707 on a period of prosperous industry which had been impossible during the war with England and the civil wars of the 17th century. The revival of agriculture set country gentlemen at work reclaiming waste lands; their increasing revenues enabled them to bring their families to town for the season to lodge in "lands" (flats, as they would be called now), erected high over the malodorous, crowded "wynds" and courts opening out of the High

Street. The Old Town had become congested in a degree incompatible with decency and sanitation. The narrow limits of the ridge whereon the city was built made lateral expansion impossible, unless the North Loch were drained away and a New Town laid out on the far side thereof. Plans were prepared by the architect James Craig, and the foundations of the first house in the New Town were laid on Oct. 26, 1767. The result has been the creation of one of the most striking urban landscapes that can be found in any country. The picturesque features of the Old Town have, indeed, been greatly impaired by the removal of at least two-thirds of the ancient "lands," as the lofty houses piled high on the ridge were called, but enough remains to offer striking contrast to the spacious streets and commodious architecture of the New Town. The scene would have been even more impressive had the North Loch been purified and retained as an ornamental sheet of water, instead of being drained and its bed occupied by the North British Railway (later part of the Scottish Region, B.R.). But enough is left to justify the pride with which her citizens speak and think of Edinburgh as the Modern Athens, the Castle Rock being no mean counterpart to the Acropolis, while the Calton Hill reflects the contours and relative position of Lycabettus.

Herbert Maxwell

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Edinburgh, ALFRED ERNEST ALBERT, DUKE OF (1844-1900). British prince. The second son of Queen Victoria, he was born at Windsor, Aug. 6, 1844. He was educated for the Navy, and in 1893 was made admiral of the fleet. In 1862 he was elected king of Greece, but for political reasons refused the crown. He was created duke of Edinburgh in 1865, and in 1893 became reigning duke of Saxe-Coburg and Gotha, surrendering his privileges as an English peer, but retaining his rank of admiral. He was a collector and a patron of music. In 1874 he married Marie Alexandrov

na, only daughter of Alexander II of Russia; she died Oct. 25, 1920. The duke died July 30, 1900, and was succeeded as duke of Saxe-Coburg by his nephew, Leopold Charles, duke of Albany.

Edinburgh, DUKE OF. For the consort of Elizabeth II, created British prince in 1957, *see* Philip, Duke of Edinburgh.

Edinburgh Academy. Scottish public school. Incorporated by royal charter, it was opened by Sir Walter Scott, 1824. The headmaster is termed the rector. The academy is divided into an upper school and a preparatory school, the junior department of which is in Denham Green House, about a mile away. Primarily a day school, it has four houses for boarders situated beside New Field, the larger of the two playing fields; the other field, Raeburn Place, was the scene of the first rugby football international in 1871. The Edinburgh Academical F.C., composed of old boys and founded 1858, is the oldest football club in Scotland.

Edinburgh Festival. Annual international festival of music and drama at Edinburgh, Scotland. First held in 1947, it lasts for three weeks in Aug. Sept. and attracts visitors from all parts of the world. Continental and British orchestras and opera companies are engaged, and new and classic plays performed by British and foreign companies; ballet performances and art exhibitions are other features.

Edinburgh Review. Famous blue-and-buff Whig organ, the first of the great critical quarterlies. It was founded by Sydney Smith, Oct., 1802. Francis Jeffrey was editor 1803-29, Macvey Napier 1829-47, William Empson 1847-52, Sir George Cornwall Lewis 1852-55, Henry Reeve 1855-95, Arthur Elliott 1895-1912, Harold Cox 1913-29, when publication ceased. Jeffrey's literary criticism provoked Byron's *English Bards and Scotch Reviewers*; and Macaulay's *Essays* first appeared in the *Edinburgh Review*.

An earlier publication of the same name, brought out in 1755 by Adam Smith, Alexander Wedderburn, and others ran to only two numbers.

Edinburgh University. Scottish institution of higher learning. It was founded in 1583 as the Town's College by the town council of Edinburgh on the authority of a royal charter granted by King James VI in 1582. A later charter of 1621 gave the college all the rights and privileges of "any college . . . within His

Majesty's realm," including the (already assumed) right of conferring degrees. It remained legally the Town's College until 1858 when by the Universities (Scotland) Act all the Scottish universities obtained new and autonomous constitutions. The basis of the present constitution is the Universities (Scotland) Act of 1889. Under its terms the chief governing body is the court (in which the town council is represented), teaching and discipline being regulated by the Senatus Academicus. The principal constitutional officers are the chancellor, the vice-chancellor (who is also the principal), and the rector, who is elected by the students for a term of three years. The present Old College was built during 1789-1828, to a design of Robert Adam revised by W. H. Playfair, on the original Kirk-o'-Field site of the university. It houses the administrative offices, the common rooms, some arts departments, and the library which incorporates Playfair's beautiful hall and contains about 650,000 volumes. The famous medical school is situated separately in the New Buildings, and among other university buildings are the King's Buildings (science), the McEwan Hall (the graduation hall), the University Union, the dental college, the veterinary college, and Adam House (examination halls and theatre). There are six faculties: divinity, law, medicine, arts, science, and music and there were 6,657 matriculated students in the session 1955-56.

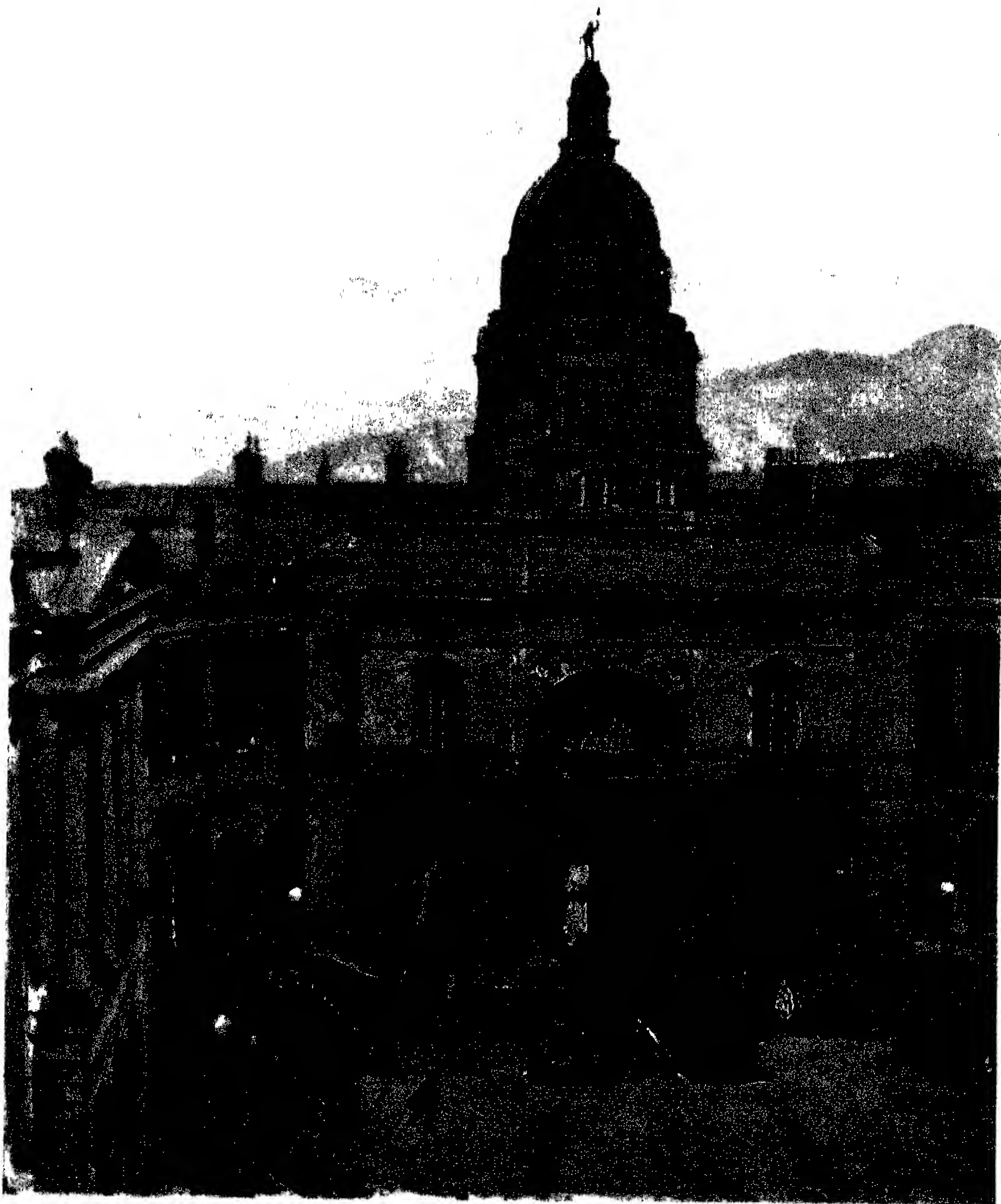
Edirne. *See* Adrianople.

Edison, THOMAS ALVA (1847-1931). American inventor. Edison was born at Milan, Ohio, Feb. 11, 1847, of mixed Dutch and Scottish descent, and had almost no regular education. When he was 12 years old he became a news-



Thomas A. Edison

boy on a railway, and at 15 was printing his own newspaper, *The Grand Trunk Herald*, on a train in motion. He began his technical career as a telegraph operator on the Grand Trunk rly., and made his first invention, a vote-recording machine, when he was 21. This was followed by the first really practical tape machine and a remarkable series of improvements on



Edinburgh University, youngest of the four Universities of Scotland, was founded in 1583 as the Town's College by the town council of Edinburgh. The buildings shown, put up during 1789-1828, occupy the site of Kirk o' Field, blown up when Lord Darnley was murdered

there in 1567, and house the administrative offices and the library as well as some of the teaching departments of the University. This picture of the Old College is reproduced from a painting made by Stephen Bone specially for the New Universal Encyclopedia

EDINBURGH UNIVERSITY: THE OLD COLLEGE

the then crude methods of electrical transmission.

Edison next interested himself in telephony, enormously improving the system based on Bell's invention, and invented the phonograph, first machine for recording and reproducing sound. By developing the carbon filament in 1879, he advanced electric lighting. In 1887 he invented the kinetoscope, the direct forerunner of the cinematograph, and other subjects on which he worked included magnetic ore separation, storage batteries, motor vehicles, railway signalling, and typewriters. Turning to chemistry, during the First Great War he designed benzol and carbonic acid producing plants. He was granted some 1,300 patents, and he was honoured by many scientific bodies. The range of Edison's inventions was such that he has left his mark on nearly every branch of science, though much of his work took the form of improving appliances invented by others. He died Oct. 18, 1931. Among many Lives are those by F. A. Jones, 1925; F. T. Miller, 1932; W. A. Simonds, 1935; consult also Edison as I Knew Him, Henry Ford, 1930.

Edith Cavell. Mt. of Canada. A peak of the Rocky Mts., it is situated in Alberta, close to the border of British Columbia, 14 m. S. of Jasper. It is 11,033 ft. high, and was named after Nurse Edith Cavell. See Cavell, Edith.

Editor (Lat. *edere*, to produce). One who controls the production and contents of a newspaper, book, or magazine. On daily newspapers his personality and political and business acumen and knowledge of men and affairs are more vital than literary facility, the necessity of his close attention to detail being obviated by subdivision of labour. In book and magazine production he needs special qualifications according to the nature of the work on which he is engaged. In all cases practical knowledge of the various processes connected with printing, illustration, etc., is essential. See Journalism; Newspaper.

Edmonton. A municipal borough of Middlesex, England, adjoining Tottenham, Enfield, and Southgate, and bounded on the E. by the river Lea, which also divides Middlesex and Essex. The New river passes through part of the W. of the bor. Edmonton, which is served by railway and London Transport, has a number of light industries, and there is

timber trade on the Lea. It is associated with Cowper (cf. John Gilpin) and Keats; and Charles and Mary Lamb lie buried in the parish churchyard. It suffered considerable damage from air raids during the Second Great War. Edmonton forms a bor. constituency. Pop. (1951) 104,244.

Edmonton. Capital and largest city of Alberta, Canada. It is on the N. bank of the North Saskatchewan river, 793 m. W. of Winnipeg and 771 m. E. of Vancouver, and is served by the C.P.R. and C.N.R. The provincial parliament buildings stand N. of the river, while to the S. is the university of Alberta, founded in 1906. The city owns electric light and power, water, telephone, and street rly.



Edmonton, Canada. Air view of the town showing (centre) the high level bridge; upper picture, the Parliament buildings of the province of Alberta, also to be seen, right centre, in the lower picture

systems. Edmonton is the gateway to the northern minefields and a rich petroleum-bearing area, and an agricultural and an industrial centre. There are oil pipe-lines to Superior, Wis., built 1949-51; and across the Rockies to Vancouver, opened 1953. Pop. (1951) 159,631.

Edmund OR **EDMUND** (841-70). English saint, king of East Anglia. Late legends describe him as the son of Alkmund, king of the Saxons, and state that he was born at Nuremberg and adopted by Offa, whom he succeeded as king of East Anglia in 855. Captured by the Danes on their invasion in 870 and refusing to give up Christianity, he was beheaded at Hoxne, Suffolk. His body was removed

in the 9th century to Bury (now known as Bury St. Edmunds), where the famous shrine was erected. He was held in great veneration as a saint, many English churches are dedicated to him, and his festival is kept on Nov. 20. Consult The History of King Eadmund the Martyr, ed. Lord F. Hervey, 1929.

Edmund (c. 922-46). King of the English. The son of Edward the Elder and grandson of Alfred

the Great, he succeeded his half-brother Athelstan in 940. He fought against the Danes in the north, the result being a division of the kingdom. This did not last long, as Edmund crushed the Danes in Mercia, and was again ruler of the whole land. He subdued Cumbria in 945 and bestowed it on Malcolm, king of Scotland, on condition that he should be his "fellow-worker by sea and land." He was mortally stabbed by an outlaw at Pucklechurch, Gloucestershire, May 26, 946, and was buried at Glastonbury. Edmund's military victories and reforms in church and state gained him the names of the Deed-doer and Magnificent. His

the ministrations of a highly specialised clergy schooled in the sacred writings and traditions; and they almost invariably entailed conforming membership of a close and sometimes jealous worshipping community. So in a sense the notion of individuality in Christian thought has always been a strongly conditional one.

In these circumstances it was inevitable that Christian education would be seen as a sort of withdrawal from self and worldly involvement. It would necessarily include much specialised vocational training, such as the mastery of Latin (the international language), the acquisition of logical and rhetorical skill for participation in theological discussions, and a thorough knowledge of the observances, beliefs, and great books of the Church. Until well into the 17th century these studies were the staple fare of the schools of Europe. Children were variously seen as empty vessels to be filled, as "little men" to whose immaturity no special consideration except strict discipline should be given, or as potential wantons needing to be rescued from their waywardness. The other kinds of education—through apprenticeship to the court, to war, or to trades—were considered to be of incomparably lower importance.

Value of Work

Of course, there were protests, though these were often submerged or diverted from education. Benedict (c. 480-543) stressed the educative and religious value of work; but the great abbeys of his order became centres of withdrawal. The communities of friars carried their campaign out into the world, including the realm of worldly learning. Also, the humanist spirit of the Greeks stirred even the arid scholarship of the Latin schools. A mighty genius like Thomas Aquinas (c. 1225-74) could see that there need be no conflict between natural law and divine law, between reasoned examination and divine revelation. Aristotle's philosophy, hitherto only partly known and indeed recently condemned by religious authorities, was made respectable through the advocacy of Aquinas. The Greek's compendious examination of ethics, natural history, literary criticism, and the like was taken up by far-sighted scholars. Together with Arabic translations of Aristotle, Europe acquired a knowledge of Arab mathematics and science. An eager enthusiasm

for long-neglected Greek authors inflamed Christendom. Aristotle was "adopted" by theologians. The secularists in public and private life threw themselves with zest into the enjoyment of human achievements; but most schools felt little effect of all this Renaissance except the inclusion of more subjects in the curriculum.

But the type of humanist who was more than a Classical philologist very soon loudly advocated educational change. Reason, rather than faith or prescription, was increasingly considered the guiding force in human life. Life should also be enjoyed, and enriched both by the development of personal qualities and by the acquisition of up-to-date knowledge, no less than by traditional scholarship. Moreover, the harshness of medieval schooldays was repudiated by many who urged that children should be brought along from interest to interest at their own pace.

Advances in Theory

This advance in thought was cosmopolitan and piecemeal, including the contributions of Rabelais (French), Erasmus (Dutch), Vives (Spanish), Melancthon and Luther (German), with Colet, More, Ascham, and Mulcaster among the English. Comenius (or Komenski), a Moravian born in 1592, not merely urged the study of infants and the cultivation of young children's "natural" readiness for education, but also declared that *all* children should be thus educated. He called for the scientific study of educational method. Many of his practical proposals (e.g. about school organization, the stages of child development, activity methods) sound remarkably like those of today.

Yet the advance in thought made little difference in practice. More children received formal education, sometimes because of the work of teaching orders in Roman Catholic countries, sometimes because of charitable foundations, and also because the accumulation of capital enabled more parents to buy it. As often happens when educational provision is suddenly expanded, the old familiar methods were usually followed. Rousseau re-stated and systematised the claims of a child-centred education in his *Émile*, 1762, and in more ways than one laid the foundations of infant and junior teaching as it is today; but despite this, and despite the experiments conducted in Germany during the 18th cen-

tury in accordance with the theories of Pestalozzi, Froebel, and Herbart, most schools in Europe (especially Great Britain) showed virtually no modernisation of method until the period after 1918. At this time, British educational methods were revolutionised by derivatives of the Montessori and Froebel methods for young children, and the many variations on "activity" and "self-determination" themes imported from the U.S.A. (where they had been promoted by John Dewey) to serve the needs of older children. The most earnest experiments were made in schools of all types; but many schools enjoying the greatest prestige showed little alteration.

Formal Education for All

It is nowadays assumed in most countries that everyone must have a formal education. There was long a tradition (for example until 1802 in England and Wales) that two main grades of schooling should be offered: an elementary type for the poor, and a more extended and elaborate type for those whose parents could buy it. Indeed, there were doubts in many quarters about providing even elementary education until it became clear (towards the middle of the 19th century) that the moral and social properties would be enhanced by it and not impaired. Increasing industrialisation made it necessary to secure some schooling for the majority, and the shortage of workers with technical and commercial skill called for an extension of "secondary" opportunities for able children of humbler origin. In the British Isles, where the challenge of international competition was not at first felt because of the early development of mechanisation there, the extension of education on the Continent was later seen as a threat. At home, political developments, working-class movements, and the growth of Victorian philanthropy slowly reinforced the feeling that extended education was something the nation could not afford to be without.

In 1802 an act of the British parliament made it legal for local education authorities to provide secondary education at public expense for bright children. (Such an opportunity had been possible in France for nearly a hundred years, and several other Continental countries had publicly organized systems of formal education.) Further training for the professions and industries in universities and

colleges was a natural corollary to the provision of secondary schooling; and scholarships became increasingly available. The Education Act of 1944, while permitting the continuation of private schools (from the public schools downwards), regularised arrangements for the publicly provided schools and for those which receive varying amounts of public money in exchange for agreed amounts of public control. It ensured that every British person shall receive an education according to "age, aptitude, and ability," and that financial and other handicaps shall not stand in his way. Such guarantees are afforded, more or less, in most democratic countries. Few allow so many and such powerful alternatives to the public provision as does the system in England and Wales. In some countries alternatives are forbidden, in some they are made unnecessary by the excellence of the tax-supported schools. Social traditions also greatly affect attitudes towards private schools: in Scotland and the U.S.A., for example, there are relatively very few private schools.

Secondary Education

Admitting children to higher than elementary opportunities brings in the question of their fitness for certain studies or careers. Little anxiety was felt when the number of applicants did not greatly exceed the number of places available, and when fees excluded many able children. But admission tests have become stricter in course of time, and such criteria as intelligence tests, aptitude tests, and interviews have in many places supplemented (or superseded) old-style arithmetic and language examinations. By these devices many children from comfortable homes are excluded, usually about the age of 11, from academic high schools. This type of selection is furiously debated. Parents resent the restriction on their choice of the kind of formal education their children shall have; and both parents and children resent what is felt to be the stigma of relegation; and some critics consider the tests very fallible.

Some democratic countries, *e.g.* Norway and Sweden, as well as all the Communist countries, have adopted the system of "common schooling" for all children which for historical reasons developed long ago in Scotland and in the U.S.A.

One school of thought has always tended to plump for

"nature" (*i.e.* heredity) as the predominating factor in education, while the opposing school championed "nurture," or upbringing. When social mobility was less, it was pleasant to think that schooling simply brought out innate qualities of excellence; but the spread of opportunities has shown that innate qualities had often been submerged by lack of opportunity.

It is undoubtedly true that the sheer physical drudgery of many occupations in the past, though providing the basis for civilization, has prevented many people from sharing in "cultural" pursuits and perceptions. Therefore "culture" has usually been distinguished from occupation by the ruling classes. Though there is nowadays a much smaller leisured class, it is still often supposed that the "humanities" must be divorced from vocational preparation and that they constitute the essence of a good education. They must, it is sometimes added, be fostered by schools of an academic type. This view is countered by those who believe that a "liberal" education is a matter of attitudes, which are best cultivated in a vocational context; by this means also a wider understanding of the world is said to be acquired.

Future of Education

In considering these and other problems and controversies about education it is valuable to bear in mind that the majority of the human race are hungry for food and comfort, and eager for the education which they think will ensure these. Technological training in the U.S.S.R. within 40 years equalled the standard of the West, and outstripped it in total volume. China, India, and Africa may follow suit; schools and all kinds of adult influences—radio, films, the press, industrial or social organizations—are more and more used to provide the rapid and radical transformation of societies that comprise more than half the human race. The West needs to cherish the genuine and viable part of its heritage; but that spirit will be called to leaven an increasingly industrialised and urbanised world. Only the most ruthless realism can maintain the ethos, prestige, and living standards of the traditionally advanced countries. Therefore, what looked like the approaching millennium of individualism and leisured culture during the inter-war period developed into a world-wide arena

of educational dilemma. Who shall be educated, and for what, and how, are housekeeping questions of urgent practical importance. They affect the total life of whole societies. It is no longer possible to regard education as a sort of personal portmanteau to be packed during schooldays with right knowledge, wholesome attitudes, and useful gear for a pleasant and profitable life. It is rather seen as a special aspect or emphasis of personal and social involvement in a world whose learning, working, and relaxing conditions are daily transformed.

Education, MINISTRY OF. British government department established by the Education Act, 1944, as the legal successor of the board of Education, constituted in 1899. It is the duty of the minister "to promote the education of the people of England and Wales and the progressive development of institutions devoted to that purpose." Whereas the president of the board of Education could claim to be consulted by local education authorities, could advise them, and could partially control them by withholding grants from central funds, the minister of Education was given statutory power to direct local authorities to act in order that a national policy is carried out. A central advisory council for education for England, and another for Wales and Monmouthshire, appointed by the minister, advise him upon "such matters connected with educational theory and practice as they think fit and upon any questions referred to them by him." The h.q. of the ministry is in Curzon St., London, W.1.

Education in Scotland is supervised by the Scottish Education department, under the general control of the secretary for Scotland. An Education (Scotland) Act was passed in 1946, applying to Scotland provisions similar to those of the Education Act, 1944. N. Ireland has its own ministry of Education, under the control of the N. Ireland parliament.

Education Acts OF GREAT BRITAIN. Acts passed to improve at public expense the general state of education. Government intervention in education began in 1834 when parliament made a grant of £20,000 for school buildings to the British School Society and the National Society. The Elementary Education Act of 1870 (Forster Act) set up elected school boards, with power to raise money from local rates, in districts where school

accommodation was insufficient. An amending Act of 1876 made it the duty of the parent to see that every child received elementary instruction in "reading, writing, and arithmetic." An Act of 1880 required local authorities to enforce attendance. The Technical Instruction Act of 1889 empowered councils to levy a rate not exceeding a penny in the £ in aid of technical instruction; the Local Taxation Act of 1890 allowed the use for technical instruction of the imperial contributions paid to local authorities for the beer and spirit duties. This so-called "whisky-money" greatly helped the establishment of technical colleges throughout the country. An Act of 1899 set up the board of Education. The Education Act of 1902 (Balfour Act) abolished school boards, and made the county or county borough the authority for all forms of education, a special Act dealing with London being passed in the following year. The Education Act of 1918 (Fisher Act), re-enacted by the Education (Consolidation) Act of 1921, gave wide powers to local education authorities to provide adequately for the physical, as well as mental, welfare of children of all types from two years old. It raised the school-leaving age from 12 to 14, and gave the local authority power to raise the age to 15, a power never acted on.

The Butler Act of 1944

The Education Act of 1944 (Butler Act) revolutionised the English educational system. It established a ministry of Education (*q.v.*); it unified the control of all forms of education within each area; it provided for a unified statutory system of public education, organized in three progressive stages known as primary, secondary, and further; it sanctioned the raising of the school-leaving age to 15, and subsequently to 16; it provided for the establishment of county colleges, at which adolescent workers up to 18 years of age must attend for the equivalent of one day a week; it abolished fees for secondary education in publicly financed schools; and it contained schemes for a vast expansion of educational services of many kinds, including those for adults. An amending Act (1946) clarified a few points in the main Act, and also removed the ban on membership by teachers of certain public bodies.

Edward. Masculine Christian name. Of Teutonic origin, it means able to guard. It was popular

among the Anglo-Saxons, being borne by Edward the Elder, Edward the Confessor, and other kings, and has since been one of the most used of English names. The Anglo-Saxon Edward is sometimes spelled Eadward, a form which gives the best idea of the diphthong with which it began in that tongue. Eduard, Edouard, and Edoardo are respectively the German, French, and Italian forms.

Edward, Lake, formerly Albert Edward Nyanza. Lake of East Central Africa, 150 m. W. of the Victoria Nyanza. Lying at an alt. of 3,000 ft. above sea level, it is connected on the N.E. by a tortuous channel with Lake George. The latter was discovered by H. M. Stanley in 1875, who believed it to form part of the Albert Nyanza; but, while tracing the source of the Semliki river in 1889, he discovered the lake he named Albert Edward Nyanza, and also the channel connecting it with Lake George. The length of Edward Lake is 44 m. and the breadth 33 m.

Edward THE CONFESSOR (c. 1005-66). King of the English. The son of Ethelred the Unready



Edward the Confessor. His great seal, the earliest known specimen

and Emma, daughter of Richard, duke of the Normans, he was born at Islip, Oxon. He was taken to Normandy by his parents when Sweyn became king in 1013. Invited to England in 1041 by his half-brother, Hardicanute, when the latter died in the following year Edward was chosen king, and placed on the throne largely by the help of Earl Godwin, whose daughter Edith he married in 1045.

Edward, who was probably an albino, had the unusual qualities for a Saxon king of abstemiousness, kindness, and humility, and was long remembered in affection; but he was scarcely an effectual ruler. His reign was peaceful, though marked by struggles for power between the English and the Normans, the latter being be-

friendred by the king. Edward's chief interest was religion, and he devoted a large part of his revenues to the erection of Westminster Abbey. It was consecrated Dec. 28, 1065, and Edward died Jan. 5, 1066. He was canonised in 1161, and his festival is kept on Oct. 13. *Consult* Lives of Edward the Confessor, ed. H. R. Luard, Rolls Series, 1858.

Edward THE ELDER (d. 924). King of the English. The son of Alfred the Great, he fought with him against the Danes. He was called king before his father's death, and in 901 the witan chose him as Alfred's successor. His succession was disputed by his cousin Ethelwold, who rebelled and was slain in battle in 905. By 918 Edward brought the Danes into subjection; in 919, on the death of his sister Ethelreda, he absorbed Mercia; and in 921 he subdued the Welsh. He ruled as far north as the Humber, and his overlordship was acknowledged by all the other kings. The "unconquered king," as Florence of Worcester calls him, died at Farndon, Northants, and was buried at Winchester. His son Athelstan succeeded him.

Edward THE MARTYR (c. 963-978). King of the English. The son of Edgar, he found his right to the throne disputed on Edgar's death in 975 by his stepmother Elfrida, who put forward her son Ethelred (the Unready). Edward was supported by Archbishop Dunstan, and was crowned. On March 18, 978, he was assassinated at Corfe Castle by Elfrida's orders, while being offered a drinking-cup, and was hastily buried at Wareham. In 980 his body was transferred to Shaftesbury, and his tomb became a place of pilgrimage. He was long revered as saint and martyr, his festival being kept on March 18.

Edward I (1239-1307). King of England. The eldest son of Henry III, he was born at Westminster, June 17, 1239. In the differences between the crown and the baronage, Edward sided with his father, and was taken prisoner after the battle of Lewes, May 14, 1264. He escaped, however, and directed the royalist victory over Simon de Montfort at Evesham, Aug. 4, 1265. He succeeded to the throne



Edward I.
King of England.
1272-1307

in 1272. During his reign, Edward conquered Wales, and endeavoured to form a united kingdom embracing the whole island by asserting his sovereignty over Scotland, which regularly rebelled whenever the king was seriously engaged elsewhere. Edward was at the head of an invading army when he died, July 7, 1307, at Burgh-on-Sands.

Edward ranks as one of the greatest kings of England. He systematised the English laws, and gave the English parliamentary system its definite form by summoning to the Model parliament of 1295 not only the higher clergy and baronage, but knights and burghers. His tomb in Westminster Abbey bears the inscription, *Malleus Scotorum*, "the Hammer of the Scots," and his motto, *Pactum serva*, Keep troth. Edward's first wife was Eleanor, daughter of the king of Castile; his second was Margaret, daughter of Philip of France. Consult E. I., T. F. Tout, 1893; Welsh Wars of E. I., J. E. Morris, 1901.

Edward II (1284-1327). King of England. Son of Edward I, he was born at Carnarvon, April 25, 1284. In 1301 he was created prince of Wales at Lincoln and he acted as regent when his father



Edward II,
King of England,
1307-27

was away; however, he early revealed the indolence and levity that finally destroyed him. In 1306 he was given the province of Gascony, and in 1307 he became

king. He abandoned the war against Scotland, and was married to Isabella of France.

Edward was already under the influence of Piers Gaveston. The barons took up arms with Edward's cousin, earl Thomas of Lancaster, at their head, and they forced upon the king the banishment of Gaveston. A reconciliation, brief and insincere, followed. In 1314 the Scotch war was renewed and Edward suffered defeat at Bannockburn. This was Lancaster's opportunity, and for a time the king was a cipher, but he found fresh favourites in the Despenchers, and a combination of circumstances brought about the defeat and death of earl Thomas in 1322. Edward and the Despenchers were then supreme until 1326. Isabella, alienated from her husband, crossed from France with some followers. Caught in Wales, he was formally deposed, and on Sept. 21, 1327, he was murdered at Berkeley Castle.

Consult Place of the Reign of Edward II in English History, T. F. Tout, 1914; see Carnarvon illus.

Edward III (1312-77). King of England. Born Nov. 13, 1312, he was raised to the throne by the deposition of his father, Edward II (Jan., 1327). The government was in the hands of the queen-mother Isabella and Roger Mortimer till the young king, who married Philippa of Hainault, 1328, overthrew them by a *coup d'état* in 1330.

At first Edward warred against the Scots, but his ambitions were soon turned to France, and in 1338 began the Hundred Years' War. In the course of it he secured the English supremacy of the narrow seas by the naval victory of Sluys, June 24, 1340, established the prestige of the English soldiery and the military supremacy of the English archers by the startling victory of Crécy, Aug. 26, 1346; and in 1347 captured Calais. A victory was won by his son Edward the Black Prince at Poitiers, Sept. 19, 1356, and Edward was confirmed in the independent sovereignty of Aquitaine by the treaty of Brétigny in 1360. He died, prematurely senile, June 21, 1377. His family included the dukes of Clarence, York and Lancaster, whose descendants fought for the crown during the Wars of the Roses. He was the first king who conspicuously directed policy to commercial expansion, the security of the trade with Flanders being one of the objects of his French wars. See Lives, W. Longman, 1869; W. Warburton, 2nd ed. 1876; J. Mackinnon, 1900.

Edward IV (1442-83). King of England. The eldest son of Richard duke of York, and Cicely Neville. he was born at Rouen, April 28, 1442. In Dec., 1460, he became the leader of the Yorkists and their candidate for the crown. Acting with great energy, he crushed the Lancastrians at Mortimer's Cross, and in London was hailed as king. He then seated himself on the throne at Westminster on March 4, 1461.



Edward III,
King of England,
1327-77



Edward IV,
King of England,
1461-70

After a victory at Towton Edward was able to hold his own, although not absolutely secure. In 1469, however, came a change. He had made many enemies by the favour he showed to his wife's kinsfolk, the Woodvilles, and when Warwick and Clarence, the king's brother, joined his foes, his position was precarious. He prepared to meet them in the field, but the desertion of 6,000 men was fatal to his cause, and in great haste he left Lynn for the Netherlands. Returning with an army, he won battles at Barnet and Tewkesbury. In 1475 he conducted a short war with France and he had some trouble with Scotland, but in general he kept the land at peace. He died April 9, 1483. Consult Life and Reign, C. L. Scofield, 1923.

Edward V (1470-83). King of England. He was born in the Sanctuary, Westminster, Nov. 3, 1470, a son of Edward IV and Elizabeth Woodville. When he succeeded to the throne, April 9, 1483, his uncle, the duke of Gloucester, was his guardian.

Gloucester, however, imprisoned the boy king and his brother in the Tower, and had himself crowned as Richard III, July 6, 1483. According to Sir Thomas More, endorsing contemporary belief, Edward and his brother were murdered very shortly after. See Richard III.

Edward VI (1537-53). King of England. He was born at Hampton Court, Oct. 12, 1537, the son of Henry VIII and his third wife, Jane Seymour, and succeeded to the throne, Jan. 28, 1547. His uncle, the duke of Somerset, was protector and the real ruler for the first half of the reign, and on Somerset's fall and execution, to which the young king calmly assented, his rival, the earl of Warwick, later duke of Northumberland, held the chief power. The young king favoured Northumberland's plan for securing the succession of his daughter, Lady Jane Grey. Edward died at Greenwich, July 6, 1553. See King Edward VI: an appreciation, C. R. Markham, 1907.



Edward VI,
King of England,
1547-53

Edward VII (1841-1910). King of Great Britain and Ireland and of the British dominions beyond the seas, and emperor of India. Albert Edward, second child and eldest son of Queen Victoria and Prince Albert, was born at Buckingham Palace, Nov. 9, 1841, and created prince of Wales the following month. His education, planned by his father on severe and rigid lines, made his boyhood a weariness and his adolescence a struggle for emancipation. Following private tutoring, he studied science at Edinburgh and became a student first at Christ Church, Oxford, then at Trinity, Cambridge, but took no degrees. To the end of his life he preferred to learn from his inexhaustible interest in living men and women rather than from books. The most rewarding part of his education was afforded by travel. In 1859 he went to Italy and Spain, in 1860 he toured Canada and the U.S.A., and in 1862 he visited the Holy Land.

In 1863 he married Alexandra, daughter of Prince Christian of Glücksburg, heir to the throne of Denmark. Thenceforward until his accession in 1901 he resided at Marlborough House. The Sandringham estate, in Norfolk, was bought for him out of the money saved during his minority. During this period he performed such lesser representative functions as Victoria, with her preference for personal retirement in the years of her widowhood, felt herself unable to face. But until he was over fifty years old the Queen consistently declined to allow him to participate in affairs of state or even to afford him access to important dispatches. Thus his wide political knowledge, acquired externally by intercourse with politicians of all nations, lacked scope for action. The prince and his wife became the acknowledged leaders of London society, his duties also brought him into touch with people of every social grade, and his popularity was firmly established. He became a member of a royal commission on the housing of the poor, and took a particular interest in the cause of the London hospitals, an interest to some extent due to his own grave illness from typhoid in 1871. He was grand master of English freemasonry 1874-1901. In 1875 he visited India, laying a foundation for later relations between that empire and the British crown.

Despite his popularity, he was not exempt from criticism: first

for his love of the turf (he won the Derby in 1896 with Persimmon, 1900 with Diamond Jubilee, and 1909 with Minoru), but more generally for what seemed to some a tendency to select his friends from those who shunned the sterner walks of life. Criticism came nearest to a head in 1891, after the Tranby Croft baccarat case, a lawsuit following a game of cards at which the prince, who had been banker, appeared as a witness. But the incident was overlooked in the widespread sympathy expressed six months later on the death of his eldest son, the duke of Clarence, Jan., 1892.



Edward VII R. & J.

Edward succeeded to the throne in his sixtieth year, and reigned only nine years, during which his health required increasing care. His coronation, fixed for June 26, 1902, was postponed at short notice by an operation for appendicitis, his second serious illness, though he recovered in time to go through a shortened ceremony on Aug. 9. Yet during his brief reign he evinced a more ready aptitude for kingship than had been generally expected. In 1903 he paid a series of European visits devoted to strengthening friendship with France, Italy, and Portugal, in the first case setting the seal of his personality on the establishment of the *entente cordiale*. Three visits to Ireland were made with a similar object, and later he went twice to Germany, whose emperor bore public testimony to his uncle's "unremitting endeavours" in the cause of peace. His diplomacy averted war between Sweden and Norway in 1905. All these activities earned him in his own lifetime the sobriquet of

Edward the Peacemaker. At home, while revealing a clear appreciation of the functions of a constitutional sovereign, he did much to consolidate the personal dignity of the monarch, restoring most of the brilliant pageantry associated with the court which had lapsed under Victoria.

He died at Buckingham Palace, May 6, 1910, following an attack of bronchitis, and was buried May 20 in St. George's Chapel, Windsor. Nine sovereigns attended his funeral: his son George V, the German emperor, and the kings of Spain, Portugal, Norway, Denmark, Belgium, Greece, and Bulgaria. Five of his children survived infancy: Albert Victor, duke of Clarence (1864-92), George V (*q.v.*), and the princesses Louise (1867-1931), Victoria (1868-1935), and Maud (1869-1938), queen of Norway. The statue of Edward in Waterloo Place, London, is one part of the national memorial, the other being Shadwell Park.

Edward's short reign has given the name "Edwardian" to a recognizable period, suggesting in retrospect the final golden effulgence of 19th century prosperity, comfort, and security, projected into the first decade of the 20th century, and marked in social life as in the arts by a prodigality of display and decoration amounting at times to ornateness when judged by later standards: a period when the austerity of Victorian days were relaxed and grim problems of later years had scarcely appeared above the horizon.

Bibliography. *Official Life*, Sir S. Lee, 2 vols., 1925-27; *The Delightful Profession, a Study in Kingship*, H. E. Wortham, 1931; *Edward VII*, E. F. Benson, 1934; *Edward VII and his Times*, A. Maurain (Eng. trans. H. Miles), 1936; *Edward the Seventh*, C. Gavin, 1941; *Victoria's Heir*, G. Dangerfield, 1942; *Reminiscences of Three Reigns*, Sir F. (Lord) Ponsonby, 1951.

Edward VIII (b. 1894). The eldest son of King George V was born June 23, 1894, and succeeded his father Jan. 20, 1936. He abdicated Dec. 11 the same year, after the shortest reign in England (327 days) since that of Edward V, and was granted the title of duke of Windsor. *See Windsor, Duke of.*

Edward (1330-76) known as the Black Prince. Eldest son of Edward III of England, he was born at Woodstock, June 15, 1330; in 1333 was made earl of Chester, four years later duke of Cornwall, and in 1343 prince of Wales. He accompanied his father on the French campaign and distinguished



Edward,
the Black Prince
from an old engraving

himself at the battle of Crecy, Aug. 26, 1346. He was at the capture of Calais, and in 1350 in the sea fight off Winchelsea against the Spaniards. In 1355 Edward

was sent to Gascony, when he led the English armies in a series of raids over the French territory. A similar expedition culminated on Sept. 19, 1356, in the battle of Poitiers.

In 1357 he returned to England and in 1361 married his cousin Joan, known as the Fair Maid of Kent. In 1362 his father granted him Gascony and Aquitaine. He took part in a disastrous expedition for replacing Pedro of Castile on the throne, but soon many disaffected lords of his territories rose against him and towns surrendered to them. When, after a month's siege, he retook Limoges, he ordered a general massacre of its inhabitants. In 1371 Edward returned, in broken health, to England. He supported the bishops against the evil administration of his brother Lancaster. He died at Westminster, June 8, 1376, and was buried in Canterbury Cathedral. He was given the name Black Prince by the French, who described him as "a prince of darkness" because of the terror of his campaign in the Hundred Years' War. The belief that he was called the Black Prince because of his black armour is contradicted by the fact that he usually wore gilt armour. While Edward was a superb warrior and has been looked upon as a model of chivalry, his work was wholly unconstructive and his personal character deteriorated after about 1360. Richard II was his son.

Edward (b. 1884). Duke of Saxe-Coburg-Gotha. Prince Charles Edward was born at Claremont, Esher, Surrey, July 19, 1884, as the duke of Albany, posthumous son of Duke Leopold, 4th child of Queen Victoria. He succeeded his uncle Alfred in 1900 as duke of Saxe-Coburg-Gotha, where he ruled until Nov., 1918. He had been a Prussian general, and after his abdication joined the Nazi movement and backed Hitler with part of his great wealth. The latter frequently used him for displaying the completeness with which his party embraced all social strata,

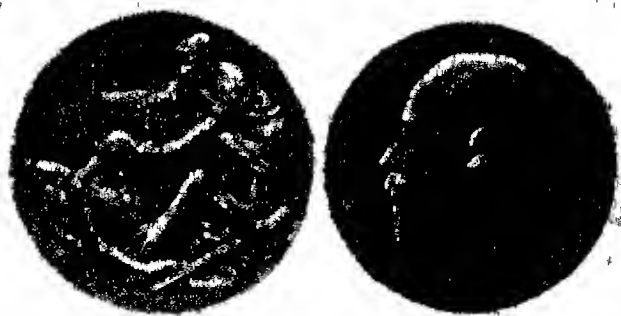
and made him a general of the party army. He represented Germany at the funeral of George V in 1936.

Edward, THOMAS (1814-86). Scottish naturalist. He was born Dec. 25, 1814, at Gosport, taken by his parents to Banff at an early age, and remained there for the rest of his life. A poor shoemaker, he for many years spent the whole of his nights out of doors. He discovered between twenty and thirty species new to science, adding to the British fauna a vast number of species hitherto unknown in these islands. In 1866 he was elected an associate of the Linnean Society, and a civil list pension was awarded to him. He died April 27, 1886. Consult *Life of a Scotch Naturalist*, S. Smiles, 1876.

Edwardes, GEORGE (1852-1915). British theatrical manager. He was born Oct. 8, 1852, of Irish parents, and started his career as business manager at the Gaiety Theatre, Dublin. In 1875 he became business manager for D'Oyly Carte at the Opéra Comique, London, and went with him to the Savoy. He joined John Hollingshead as joint manager at The Gaiety, London, 1885, and in 1886 became the manager of that theatre, which he directed for nearly 30 years, producing a long series of successful musical plays. He died Oct. 4, 1915.

Edwardes, SIR HERBERT BENJAMIN (1819-68). British soldier and Indian administrator. He was born at Frodesley, Shropshire, Nov. 12, 1819, and became a cadet in the East India Company in 1840. In 1845-46 he was aide-de-camp to Sir Hugh Gough in the Punjab campaign. As first assistant to Sir Henry Lawrence, the resident at Lahore, he administered Bannu, and his courage and resourcefulness were conspicuously seen in his defeat of the diwan of Multan, 1848. Edwardes rendered signal service during the Mutiny by securing the neutrality of Afghanistan. Knighted in 1860, he died Dec. 23, 1868.

Edward Medal. Medal instituted in 1907 by Edward VII to reward heroic acts by miners,



Edward Medal, instituted as a reward for heroic deeds in civil life (reduced)

quarrymen, etc., who have endangered their lives in rescuing others so employed. It consists of two classes, the Edward medal, and the Edward medal in silver. Bars are awarded for further acts. The medal bears a portrait of King Edward. The ribbon is dark blue with narrow yellow edge.

Edwards, ALFRED GEORGE (1848-1937). British prelate, the first Anglican archbishop of Wales. Born at Llanymawddwy, Merionethshire, Nov. 2, 1848, he was educated at Jesus College, Oxford, and, having been ordained, became in 1875 headmaster of Llandovery College. In 1885 he was made vicar and rural dean of Carmarthen, in 1889 bishop of St. Asaph, and in 1920 was elected first archbishop of the new province of Wales. He retired in 1934, dying July 22, 1937. He published *Memories*, 1927.

Edwards, AMELIA ANN BLANDFORD (1831-92). British novelist and Egyptologist. She was born in London, June 7, 1831, and for many years wrote stories for *Household Words* and *All the Year Round*, articles for the *Saturday Review* and the *Morning Post*, and two successful novels, *Barbara's History*, 1864, and *Lord Brackenbury*, 1880. She visited Egypt during 1873-74, and her travel book, *A Thousand Miles up the Nile*, 1877, ran into many editions. In 1882 she founded the Egypt Exploration Fund (later Society); and she endowed the first chair of Egyptology in the U.K., at University College, London. She died April 15, 1892.

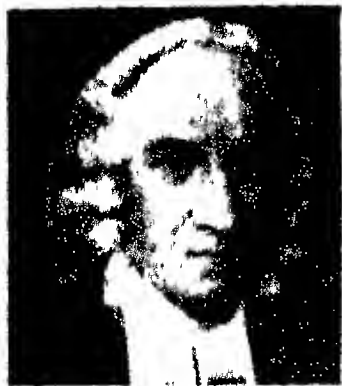
Edwards, JOHN PASSMORE (1823-1911). British journalist and philanthropist. Born at Blackwater, Cornwall, March 24, 1823, son of a carpenter, he trained himself to be a journalist, coming to London in 1846. He was proprietor and director of the London



J. Passmore Edwards,
British philanthropist
Elliott & Fry

evening journal, the *Echo*, 1876-96, and sat as Liberal M.P. for Salisbury, 1880-85. Edwards is chiefly remembered for his benefactions to hospitals, libraries, art galleries, and other public institutions, of which he founded more than 70. The settlement in Tavistock Place, London, W.C.1, was later renamed the Mary Ward Settlement. He died April 22, 1911.

Edwards, JONATHAN (1703-58). British divine and theologian. He was born Oct. 5, 1703, at East



Jonathan Edwards,
British divine

Windsor, Conn., and in 1727 became minister at Northampton, Mass. His extreme and logical Calvinism was expounded with unusual power, but his insistence on church discipline brought dismissal from the pulpit. From 1750 he resided at Stockbridge as a missionary to the River Indians, and before his death, March 22, 1758, was appointed president of Princeton College. Edwards's most important book was *A Careful and Strict Enquiry into . . . Freedom of Will*, 1754. His works were edited by S. E. Dwight, 10 vols., 1830. See Calvinism.

Edwin OR EADWINE (c. 585-633). King of Northumbria. The son of Ella, king of Deira, he was driven from Deira after his father's death by the king of Bernicia, and took refuge with Raedwald, king of E. Anglia, who defeated and slew the Bernician king in 617. Edwin then annexed Bernicia and became king of Northumbria. In 625 he married Ethelberg, sister of the king of Kent. In 627 he was baptized by Paulinus and his kingdom became Christian. Edwin's overlordship extended over all Anglo-Saxon Britain except Kent, and his rule was notable for its justice and peace. On Oct. 12, 633, Edwin was defeated and slain at Heathfield, near Doncaster, in a battle against a coalition of heathens under Penda of Mercia and Cadwallon of North Wales. Edinburgh is named after him, and he was long venerated as a saint, his day being Oct. 4.

Edwin and Angelina. Simple ballad, sometimes called *The Hermit*, by Oliver Goldsmith. It was privately printed for the countess of Northumberland in 1765 and first published in *The Vicar of Wakefield* (1766), where it is introduced by way of contrast with the false taste and meretricious exuberance of language in the poetry of the time. It tells of the coming together of separated lovers. From this ballad the names have come to be applied to any loving young couple.

Edwin Drood. The full title of Charles Dickens's unfinished novel is *The Mystery of Edwin Drood* (q.v.). See also *Drood Controversy*.

Edwy OR EADWIG (c. 940-959). King of the English. Known as the Fair, he was the son of Edmund who was murdered in 946, and succeeded his uncle Edred who died Nov. 23, 955. He appears to have been a quarrelsome youth, offending his counsellor Dunstan, who was exiled, and driving the northern nobles to rebellion. He died Oct. 1, 959, was buried at Winchester, and was succeeded by his brother Edgar.

Eeckhout, GERBRAND VAN DEN (1621-74). Dutch painter. Born at Amsterdam, Aug. 19, 1621, he was the favourite pupil and later the friend of Rembrandt. He painted genre pictures, portraits, and scriptural subjects, but his cabinet pictures are superior to those on a larger scale. Among his works which were in German galleries may be mentioned *The Raising of Jairus's Daughter*, *Tobit and the Angel*, *The Presentation of Jesus in the Temple*, *Jesus Among the Doctors*; and the portraits of Oliver Dapper, the geographer, and Rembrandt. He also executed etchings. Eeckhout died at Amsterdam, Sept. 29, 1674.

Eecloo. Town of Belgium, in the prov. of E. Flanders. It stands on the Liève, 11½ m. N.W. of Ghent. A rly. junction, it is connected also with neighbouring towns by tramways. It carries on a large trade in grain, and its manufactures include lace, woollen, and linen goods. Pop. 14,672.

Eel (*Anguillidae*). Group of fishes with elongated snake-like bodies and no visible scales. They are



Eel. The common eel found in both sea and fresh water

found in both sea and fresh waters in most parts of the tropical and temperate regions of the world. The common European eel (*A. anguilla*) is a familiar example.

The life history of the eel, long a complete mystery, was worked out by the Danish zoologist Johannes Schmidt. It is now known that the silver and yellow eels are not two varieties, but different stages in the life history. In autumn the mature silver eels migrate down the rivers to the sea, and those in ponds will often go overland for considerable distances at night to reach the rivers. Eels spawn in

the Sargasso Sea during winter, in deep water. The eggs hatch out as little fish known as *Leptocephali* or glass fishes, or elvers, so entirely unlike their parents that they were formerly thought to be a distinct species. They are flat, ribbon-like creatures about 3 ins. long, curiously deep in body, scaleless and transparent, with small heads. These *Leptocephali* do not appear to feed in the sea, and they gradually shrink both in length and depth, and become round in body, when they are known as glass eels. In this state they make their way up the rivers in countless millions. In ponds eels often live for several years before descending to the sea to spawn. They die after depositing their eggs. The grown male is smaller than the female.

Eels are used as food by most European nations. Most of those eaten in Great Britain come from Holland and Denmark. Before the First Great War the Germans had established a large elver-catching depot on the Severn.

With certain exceptions it is illegal to fish for eels with rod and line between March 14 and June 16. For the protection of salmon it is made illegal, with minor exceptions, to use an eel basket, net, or trap between Dec. 31 and June 25 in waters frequented by salmon or migratory trout. The ministry of Agriculture and Fisheries may make orders regulating eel and elver fisheries. See also *Conger*.

Eel, Electric (*Gymnotus electricus*). Large eel-like fish found in the rivers of Brazil and Guiana. Though resembling an eel in general appearance, it is widely removed from it in internal structure. It attains a length of 6 ft., and is notable for the powerful electric shock that it can give. The electricity is generated by four organs lying in pairs under the skin, but their precise mode of action is not fully understood. The animal uses this power for killing or stunning the fish on which it feeds, as well as in self-defence. The force of the shock varies greatly, but is sometimes so strong that it would overpower a horse. See *Electric Fish*.



Electric Eel. A large fish which can impart an electric shock

Eel-grass (*Vallisneria spiralis*). Perennial aquatic herb, member of the family Hydrocharitaceae. It is a native of warm and temperate regions, including S. Europe. The short stem is immersed in the mud of rivers and lakes, and from it arises a tuft of thin grass-like leaves a yard long, but only $\frac{1}{4}$ in. wide. The female flower has a very long spiral stalk which enables it to lie upon the surface of the water. The male flowers (produced by separate plants) have very short stalks which break away from their attachment, so that they float to the surface, where they pollinate the females. This accomplished, the female, by the spiral contraction of its stalk, is withdrawn to the bottom, where it develops into a cylindrical berry.



Eel-grass. Plants of the aquatic herb

Eel Pie Island. Islet in the Thames opposite York House, Twickenham. Also called Twickenham Eyot, it has long been noted as a favourite resort of anglers and boating parties. The inn on the islet occupies the place of Eel Pie House, pulled down in 1830.

Eelpout (*Lota lota*). Popular name for the burbot. It is a freshwater fish, common in European and American rivers, and in Great Britain found chiefly in the Cam and the Ouse. It is about a yard long and somewhat eel-like in shape.

Effendi. Turkish title of respect. It is applied in the East to government officials, men of learning, and others. It is a corruption of the Greek *authentēs* (mod. pron. afthendēs), a lord.

Effervescence (Lat. *effervesce*, to boil up). Name applied to the phenomenon of the rapid escape of gas from a liquid. It is usually the result of chemical action. A familiar example is seen in the mixing of a seidlitz powder with water. When soda water is withdrawn from a siphon the evolution of carbon dioxide is due to physical causes.

Efficiency (Lat. *efficientia*, a. carrying out). Term meaning in general the quality of producing some desired result. Apart from its use in engineering it is increasingly used in industrialism and economics, considerable attention being paid by doctors and others to the efficiency of the worker.

In engineering, efficiency is the ratio of the amount of energy given out from a conducting, con-

verting, or transmitting device to the energy received by it. The efficiency is invariably less than unity, as some of the energy is dissipated or used up unprofitably. The efficiency of a joint is the ratio of the strength of the joint to a similar section of unjointed material. In aeronautics, where the main spars are spliced, the efficiency of the splice is its strength relative to that of unspliced material of similar section.

The heat-absorbing efficiency of a boiler is represented by the percentage of the heat units of the burnt fuel which is found in the water and steam. The efficiency in very good boilers may be as high as 80 p.c. The heat-converting efficiency of a steam engine is its capacity for converting units of heat energy into units of mechanical work on the basis of one thermal unit being equivalent to 778 foot-pounds of work. So much heat is wasted by conduction, condensation, etc., that the efficiency, even in the best engines, does not exceed 15 p.c. to 18 p.c. The brake or effective h.p. of an engine is less than the indicated h.p., owing to loss in overcoming friction. Similarly, the converting efficiency of a dynamo or electric motor respectively is its capacity for transforming mechanical into electrical, or electrical into mechanical energy. The difference between energy units received and delivered de-

cides the transmitting efficiency of lines of shafting, belt drives, etc.

A good example of the cumulative effect of losses due to efficiencies being less than unity is afforded by the propelling apparatus of a ship. Assuming a boiler efficiency of 75 p.c., an engine heat-efficiency of 15 p.c., a transmitting efficiency of 90 p.c., and a propeller efficiency of 60 p.c.—all well above the average—out of 100 units of heat-energy developed by the burning of boiler fuel only $(100 \times \frac{75}{100} \times \frac{15}{100} \times \frac{90}{100} \times \frac{60}{100})$ 6.075 p.c. are converted into useful work. See Boiler; Steam Engine.

Efficiency Medal (Territorial). Medal awarded to warrant officers, n.c.o.s, and men of the Territorial and auxiliary military forces of the British Commonwealth. Instituted Aug. 23, 1950, it replaced the Territorial Efficiency Medal. The Efficiency Medal (Territorial) is granted for 12 years' efficient service, provided 12 annual camps have been attended. Cadet service is credited for the award, while service in W. Africa and during war-time counts as double.

Oval in shape, the medal is of silver, and carries on the obverse the royal effigy and on the reverse the inscription "For efficient service." A subsidiary title on the mount denotes whether it is awarded for service in the Territorial army or in one of the other auxiliary services. Clasps are granted for each additional completed six years of service. The ribbon is green with narrow yellow edges. For the special ribbon worn by the H.A.C., see Territorial Efficiency Decoration. The equivalent R.A.F. decoration is the Air Efficiency Award (*q.v.*).

Effigy (Lat. *effigies*, image, likeness). Monumental effigies on tomb-lids in Christian churches from the 13th century onwards abound in England and W. Europe. Originally carvings in low relief, they developed into figures in the round, usually recumbent. Ancestral effigies, kept in great houses in ancient Egypt and Rome, suggested to medieval Europe the funeral effigies placed upon royal and other biers.

In primitive culture effigies are important adjuncts of sympathetic magic. There are palaeolithic cave-portraits of food-animals to promote their abundance, often speared symbolically to ensure success in hunting. The piercing or melting of waxen images to induce sickness or death, practised in early Egypt, Babylonia, Vedic India, Greece, and Rome, prevailed in 13th-17th century Christendom.



Effigy. An example in wax: Queen Elizabeth I in Westminster Abbey

Effingham, EARL OF. British title borne by the family of Howard from 1731 to 1816, and again since 1837. The family is descended from Lord William Howard, a son of the 2nd duke of Norfolk. He served Henry VIII and his three children and was in 1553 made Baron Howard of Effingham, in Surrey. His son Charles commanded the English fleet against the Spanish Armada and was made earl of Nottingham in 1596. The earls of Nottingham held the barony of Howard of Effingham until their extinction in 1681, when it passed to Francis, whose son Francis, 7th baron, was created earl of Effingham in 1731. In 1816 the earldom became extinct, and the barony devolved upon a kinsman, Kenneth A. Howard, created earl of Effingham in 1837. Mowbray, 6th earl was born Nov. 29, 1905, and succeeded his father 1946. An eldest son is still known as Lord Howard of Effingham.

Efflorescence (Lat. *efflorescere*, to bloom). Term applied in chemistry to the changes which some crystals undergo when exposed to air. The surface of the crystals becomes covered with a fine powder, fancifully known as flowers. The change is due to the giving up of water owing to the higher vapour pressure of the crystal compared with that of the surrounding atmosphere. A familiar example is seen in washing soda, which, at first transparent, after exposure becomes opaque on the surface. The change is due to a reduction in the quantity of water of crystallisation normally present in the crystals. The word is also used in botany for the process of flowering. See Chemistry; Crystallisation.

Effusion (Lat. *effundere*, to pour out). Escape of a gas under pressure from the vessel in which it is enclosed, through a small opening. This escape will follow precise laws expressed by Graham as follows: "The velocity with which a gas effuses varies directly as the square root of the difference of pressure on the two sides of the opening (in the vessel and outside it) and inversely as the square root of the density of the gas."

Etik. Riverain Negro tribe of the Cross river, S. Nigeria, numbering some 40,000. Their language has become established as the literary language of the Ibibio group of S.E. Nigeria, who are of the Sudanic family but possess many Bantu elements. Most of the Etik are fishermen and traders.

Eft. Properly the newt (*q.v.*). The word is often loosely applied

to various lizards, which are reptiles and not amphibians as is the newt.

Egan, PIERCE (1772-1849). British sporting author. He spent his life reporting races, prize-fights,



Pierce Egan,
British author
After Sharpley

cock-fights, cricket matches, trials, and executions. He achieved great popularity as the author of a series of sketches describing London amusements in Regency times and entitled *Life in London: or the Day and Night Scenes of Jerry Hawthorn, Esq., and his elegant friend, Corinthian Tom, accompanied by Bob Logie, the Oxonian, in their Rambles and Speeches through the Metropolis*. These were issued in monthly parts from 1821 and illustrated by L. R. and G. Cruikshank. Of his numerous other writings Pierce Egan's *Book of Sports and Mirror of Life*, 1832, was the best. He died Aug. 3, 1849.

Egba OR EGBALAND. District of Western Nigeria. It is situated N. of Lagos, and is surrounded by Ibadan, Ikorodu, Badagry, and Meko. Its area is about 1,869 sq. m. The native population consists of four local tribes known as the Egba-Alake, Egba-Oke-Ona, Egba-Agura, and the Owus. The S. is largely forest, especially from Oba to Igaun, but is well watered and productive. The N.W. is hilly and not well watered. Cotton is grown. The principal means of communication, in addition to the roads, are the Ogun river and the Lagos-Ilorin railway. The capital is Abeokuta. Pop. 69,500.

In 1857 the British government established friendly relations with the Egbas, and in 1892 a treaty of protection was arranged. The country remained an independent native kingdom within Nigeria, with a British resident, until 1914, when it was placed under the direct government of the protectorate of Nigeria.

Egbert (d. 839). King of Wessex. The son of Ealhmund, a king of Kent, he was driven into exile to the court of Charlemagne and

returned to England as king of the West Saxons in 802. He then subdued West Wales or Cornwall, defeated the king of Mercia at Ellandune, annexed Kent, and in 829 became overlord of all the English kings. He was defeated by Scandinavian pirates in 836, but in 838 routed a formidable army of Northmen and West Welsh at Hingston Down, Cornwall. The first king of England, he was succeeded by his son Ethelwulf.

Egede, HANS (1686-1758). Scandinavian missionary in Greenland. Born in Norway, and educated at Copenhagen university, he was a Lutheran minister at Vaagen, 1706-17. Four years later he went with his wife and family to Greenland, where he worked among the Eskimos for fifteen years and converted many to Christianity. In 1736 he returned to Copenhagen, but continued to superintend the missions in Greenland until his death, Nov. 5, 1758. He wrote accounts of his work, and *A Description of Greenland* (1729-31), Eng. trans. 1745. Consult *The Story of Hans Egede*, Jans Olaf, Eng. ed. 1864.

Egedes Land. That portion of E. Greenland lying N.W. of Denmark Strait and N.E. of King Christian IX Land. It is named after Hans Egede.

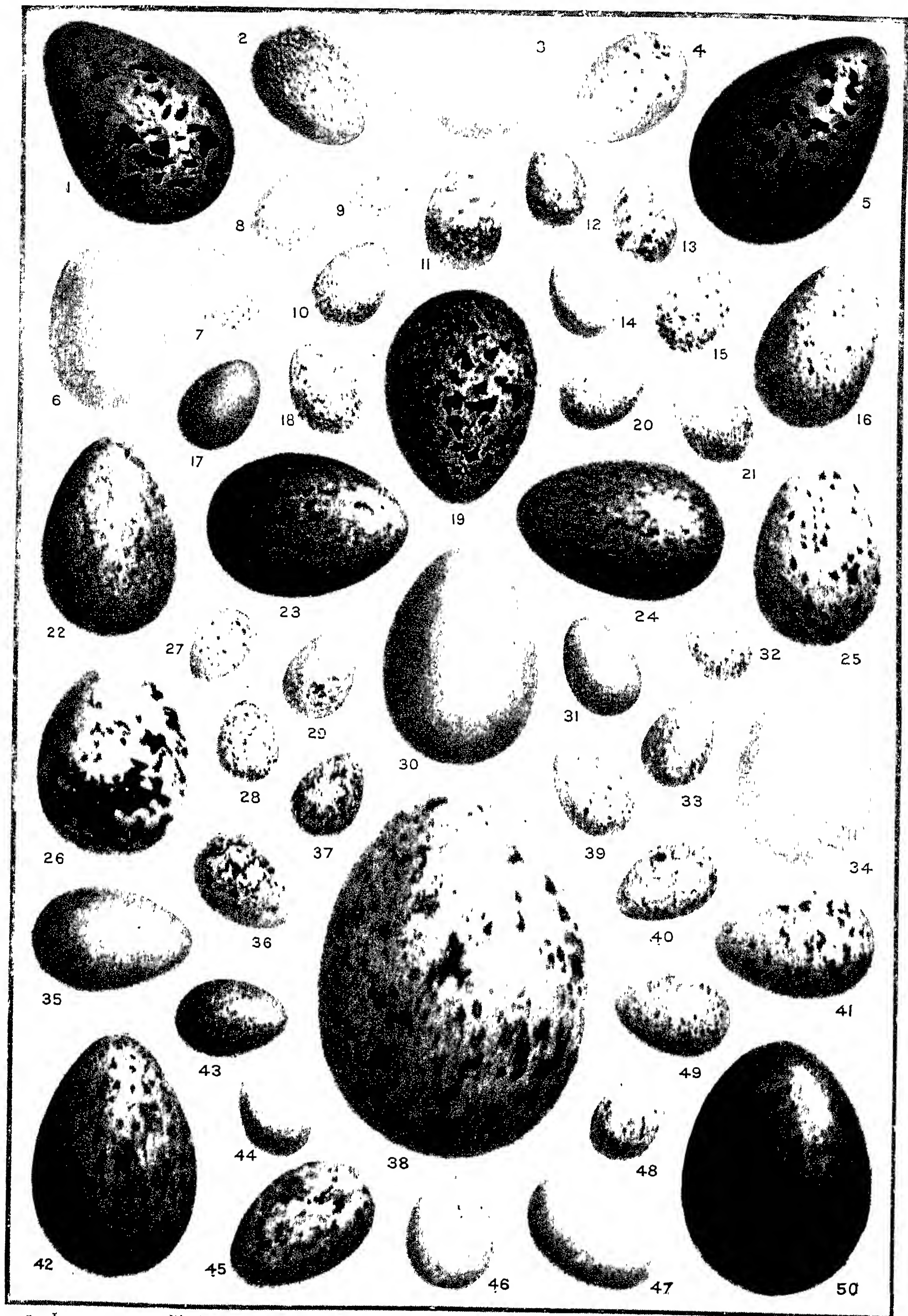
Eger. The German and more familiar name of the Czech-Slovak river Ohre. It rises in Germany in the Erzgebirge and flows generally E. through Czechoslovakia until it falls into the Elbe near Leitmeritz (Litomerice). It drains the S. side of the Erzgebirge. Cheb and Karlovy Vary (Karlsbad) are on it; length 140 m.

Eger. German name of the Czech town Cheb (*q.v.*).

Eger (Ger. Eibau). City of Hungary. It stands on the Eger, a trib. of the Tisza, in a beautiful and mountainous region, 70 m. N.E. of Budapest, and is the capital of

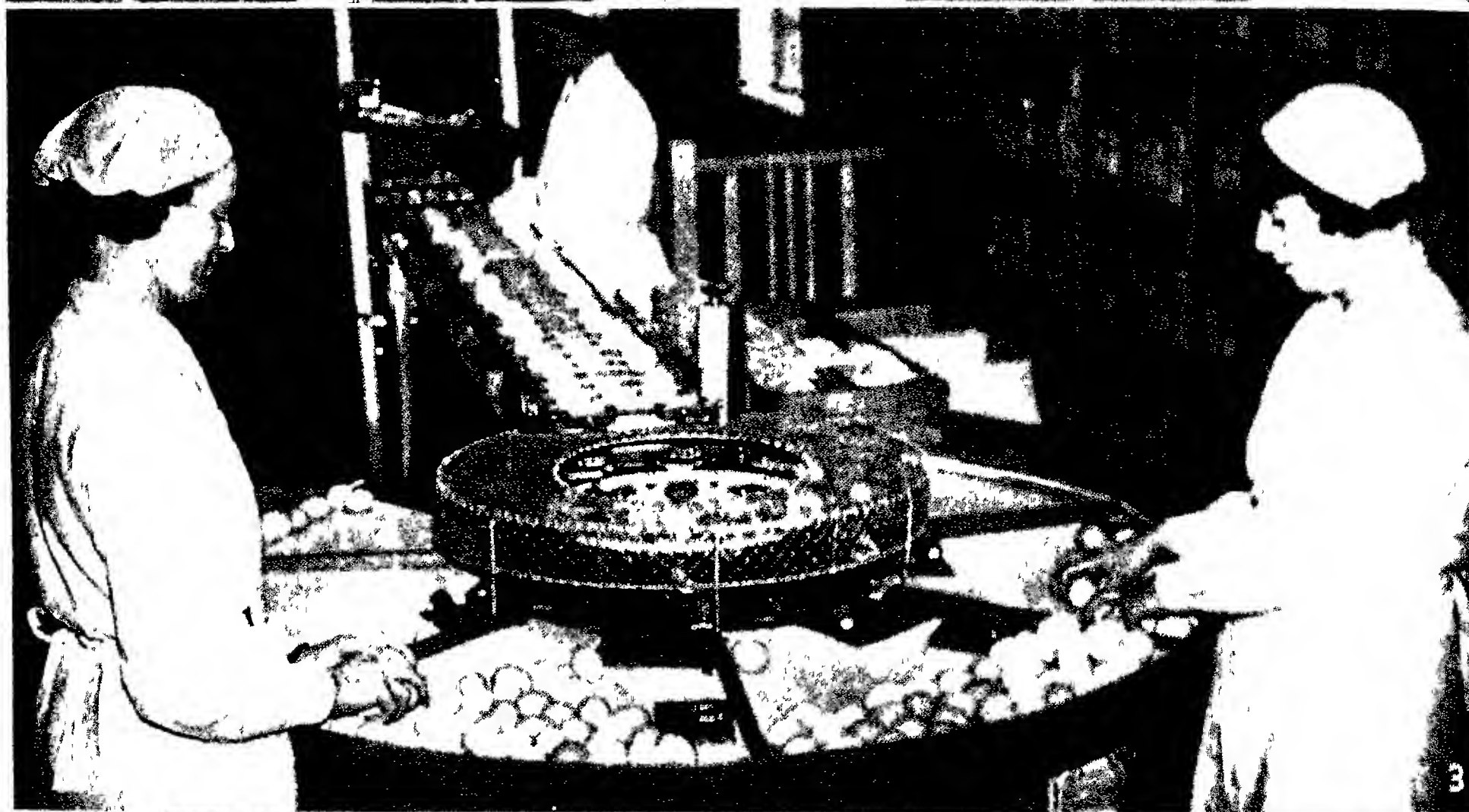
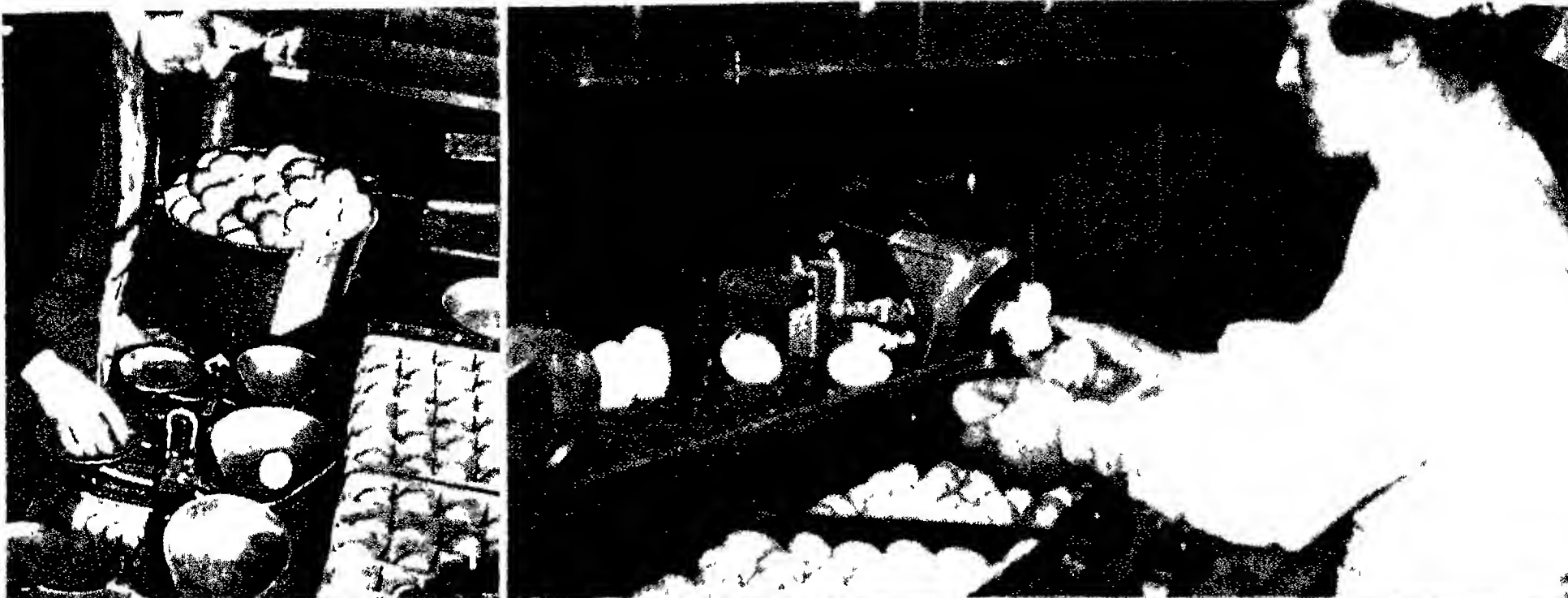


Eger, Hungary. The cathedral of this ancient city, built in the Italian style in the nineteenth century



1. Lapwing. 2. Blackbird. 3. Green woodpecker. 4. Song-thrush. 5. Golden plover. 6. Partridge. 7. Goldfinch. 8. Lesser redpole. 9. Common wren. 10. Pied wagtail. 11. Red-backed shrike. 12. Whitethroat. 13. Marsh warbler. 14. Whinchat. 15. Swallow. 16. Magpie. 17. Nightingale. 18. Spotted flycatcher. 19. Red grouse. 20. Robin. 21. Tree pipit. 22. Rook. 23. Kestrel. 24. Carrion crow. 25. Jackdaw. 26. Sparrowhawk. 27. Chiff-chaff. 28. Great tit. 29. Bullfinch. 30. Pheasant. 31. Hedge-sparrow. 32. Blue tit. 33. Blackcap. 34. Barn owl. 35. Jay. 36. Common bunting. 37. Reed warbler. 38. Golden eagle. 39. Chaffinch. 40. Yellowhammer. 41. Missel thrush. 42. Raven. 43. Skylark. 44. Stonechat. 45. Nightjar. 46. Kingfisher. 47. Starling. 48. Linnet. 49. Cuckoo. 50. Peregrine falcon.

EGGS OF FIFTY BIRDS THAT FREQUENT THE BRITISH ISLES



1. Grading eggs at the National Laying Test at Millford, Godalming, Surrey; farmers from all parts of the country enter their best laying or breeding hens, and at the end of a two-year period certificates and prizes are

awarded. 2. Testing eggs with electric light at Cheltenham egg grading station. 3. Egg grading machine at work in a West Country grading centre, the machine deals with 300 dozen eggs per hour. 4. Packing eggs

EGG: ASPECTS OF A HIGHLY ORGANIZED BRITISH INDUSTRY

the county of Heves. Its chief industry is the making of red wine, the grapes for which are grown on the hills around. The cathedral, in the Italian style, was erected in the 19th century; the church of the Brothers of Mercy and the minaret of an old mosque are also noteworthy. Other buildings include the palace of the archbishop, the town hall, and the observatory. The town grew up around the bishopric founded about 1010. It was taken by the Turks in 1596, and they kept it until 1687. In the Second Great War the approaches to Eger, the gateway to S. Slovakia, were heavily fortified by the Germans in the summer of 1944; the Russians captured the town Nov. 30. Pop. 30,328.

Egerdir. Lake of Asiatic Turkey. Lying between the Sultan Dag and the Taurus Mts., it is 27 m. long and from 3 m. to 10 m. wide. On it stands the town Egerdir.

Egeria. In classical legend, a nymph beloved of Numa Pompilius, king of Rome, who set great store by her advice and prophecies. On the death of Numa her grief was so great that she dissolved in tears, and was turned into a fountain by Diana. The name is given in modern times to a lady who stimulates and inspires a man's intellectual activity.

Egerton, Sir Alfred Charles Glyn (b. 1886). British chemist. He was educated at Eton and University College, London, became a lecturer and technical consultant at the R.M.A., Woolwich, and was reader in thermodynamics at Oxford from 1921 to 1936, when he was appointed professor of chemical technology at the Imperial College of Science. During the Second Great War he was on the scientific advisory committee to the war cabinet. Made F.R.S. in 1926, he became secretary of the society in 1938. He was knighted in 1943.

Egerton, Sir Charles Comyn (1818-1921). British soldier. He was born Nov. 10, 1848. Entering the army in 1867, he took part in Roberts's march to Kandahar, 1880, led the Indian contingent at Suakin, 1896, and commanded the Somaliland operations, being promoted full general in 1906 and field-marshal in 1917. He was a member of the council of India, 1907-17. He died Feb. 20, 1921.

Egerton Prize. Award given annually by the Admiralty to the naval officer who, when qualifying for gunnery lieutenant, passes best in the examination in practical

gunnery. The prize was founded in 1901 in memory of Commander F. G. Egerton, R.N., killed in Lady-smith, Nov. 2, 1899.

Egg. Reproductive cell formed in the body of the female animal, which, when fertilised by union with the spermatozoon of the male, produces a new individual. Except in the lowest forms of life, when propagation takes place by fission or budding, every animal begins its life history as an egg. In the viviparous animals, as in nearly all mammals, the development of the egg takes place in the body of the mother; in the oviparous it is extruded and development proceeds apart from union with the mother. (See Embryology.)

Only such eggs as are "laid" by the female and hatched externally to her body are here considered. This phenomenon occurs in all the phyla or sub-kingdoms of the animal world except certain of the lowest and most primitive. In the mollusca, which include the snails and the shell-fish, eggs vary considerably in form and size. In the largest of the British snails (*Helix pomatia*) the egg is enclosed in a chalky shell, and is as large as a moderate-sized pea; while one of the snails of Barbados (*Strophochelilus oblongus*) lays a white egg as large as that of a pigeon.

Some insects, like moths and butterflies, lay an enormous number of eggs; but the most prolific creatures of all are the fishes. The ling produces more than 500,000 eggs to each pound of her weight.

Nearly all reptiles lay eggs. Those of the crocodiles and tortoises have hard, limy shells, but most are enclosed in membranous capsules. Those of the amphibians like the frogs and newts, are deposited in gelatinous masses. Speaking generally, eggs laid in the water or in wet places are without hard external coverings.

All birds deposit eggs, varying immensely in size and colour. In size they range from that of the ostrich, which equals about twelve hens' eggs, to the tiny productions of the humming-birds. The colouring of birds' eggs is sometimes of a protective nature, and adapted to the surroundings. The eggs of razor-bills and guillemots, which lay on exposed edges of rocks, are of tapering shape, so that when disturbed by wind or by a passing bird they simply turn round. Among the mammals, eggs are laid only by ornithorhynchus and echidna. (See Biology; Birds, Protection of; Cell.)

* Paul G. 'Espinasse

EGG INDUSTRY. This deals particularly with hens' eggs produced for consumption, either in the original form or processed. In processed form, eggs are used extensively in food manufacture. In their original form, eggs are classified as fresh or store. Fresh eggs pass straight to consumer from poultry farms via the retailer. Store eggs pass from poultry farm via wholesaler to refrigerated store, and thence to retailer; they are imported from the British Dominions, and, in normal times, from Europe and China, and held in cold storage before distribution to retailers.

The increase in the production and consumption of eggs is due principally to refrigeration. With the building of cold stores there came a new incentive to the farmer to produce supplies in excess of immediate demand. Poultry farms became a paying proposition because of the possibility of conserving egg supplies from the surplus productive season (i.e., March to June). Processed eggs are those taken out of shell and processed in quantity. Eggs can be dried by evaporating the water content until flakes or powder be formed. Eggs can also be frozen in quantity out of shells. Dried egg and frozen egg are used in biscuit factories and in cake-making.

The Development of the Egg

An egg is of complex structure, a knowledge of which is necessary to ensure the proper handling and conserving of huge quantities. The egg-producing organ of the hen is called the oviduct. The yolk develops first in the ovary; it is enclosed in a sac, develops by the addition of concentric layers of yellow yolk, and, according to an American authority, requires fourteen days for full development. When the yolk is fully developed, the oviduct envelops the yolk sac. The latter splits or opens, and the yolk begins its escape through the oviduct. The male sperms are at the opening of the oviduct, and enter the yolk at the germinal disk, a light-coloured spot on the surface of the yolk. The white or albumen of the egg is laid on the yolk during its passage down the oviduct. Ligaments which suspend the yolk are twisted by the revolving motion of the yolk during its passage. Next are added the shell membranes, the shell pigment, and the outer gelatinous coating, and the egg is ready for expulsion. It takes about three hours for the formation of the first

layers of albumen, three hours for the formation of the shell membranes, and 12-20 hours for the formation of the shell, the function of the uterus and vagina, and the laying. Formation of the yolk is continuous in the sac, and there are always hundreds of minute yolks developing independently, ready for fertilisation.

The yolk varies in colour according to the food or breed of hen. When an egg is opened, the yolk should assume a rounded form and not break easily. It is lighter in weight than the white of the egg, and has a high fat content. Usually the yolk contains the following percentages: 48 water, 30 fat, and 15-20 protein. The albumen, which is a viscous fluid, should be colourless. The shell membranes consist of a network of organic fibres, and are almost transparent. The shell is a calcareous deposit about $\frac{1}{16}$ -in. thick. It is porous, permitting the easy absorption and evaporation of water and odours. The air cell is the space between the contents of the egg and the shell, caused by evaporation. The egg contracts after it has left the body of the hen, and the space caused by contraction between the two shell membranes fills with air.

Causes of Defective Eggs

Eggs are often defective, the physical condition and breed of the hen affecting quality. The size of yolk, percentage of moisture, firmness and percentage of albumen, and strength of shell can often be controlled if the hen receives careful treatment. Summer eggs have weaker albumen than those produced earlier; eggs with weak albumen do not stand cold storage. Dark yolks are due to excessive consumption of green foods by the hen. Grass eggs have dark yolks and greenish whites.

Two-yolk eggs are caused by ovarian conditions; abnormal yolks by the passage of the yolk sac into the oviduct before full development; blood clots by the rupture of blood vessels in the ovary of the hen; meat spots are floating particles in the albumen, either portions of loosened glands torn from the walls of the oviduct, or abnormal growths of tissue.

Shells differ in formation and construction through lack of lime or enforced production in which the shell does not get the requisite time for formation. There are soft shell and thin shell eggs, and shells with excessive porosity.

Shells with slight ridges do not keep well, and should be put aside.

Light float eggs contain an enlarged air cell and a darkened yolk; they deteriorate rapidly. A heavy float egg is a more advanced stage of the conditions of the light float. Blood rings around the germinal disk prove that the egg is unfit for human consumption. An opaque solidified appearance shows that the egg has been subjected to high temperatures; loose frothy appearance, together with a cracked shell, signifies freezing with subsequent thawing. Moisture or sweating of eggs caused by changes of temperature destroys the structure of the albumen. Excessive evaporation is caused by dry air passing rapidly over eggs.

Buying and collecting eggs from poultry farms, arranging for transport and storage, withdrawing from store, and selling to retailers, are in the hands of brokers and merchants working independently or on behalf of provision groups and firms. Early in April the first eggs are shipped to cold stores where they remain for several months. All eggs are usually withdrawn by the end of Jan. Selected eggs are packed in crates with cardboard divisions—fillers and flats—or with "excelsior" packing. Crates are usually 6 ft. long by 2 ft. wide and 6 in. high, each crate containing 130 dozen. The crates, when stowed in the cold chambers, should be stacked flat, with separating dunnage between the crates and floor and walls. The air circulation should be gentle, and a temperature of 32° F. and 80 p.c. humidity are also necessary. Withdrawal from store begins in October, when the supply of fresh eggs diminishes and prices increase. A.E. Miller

Egg, AUGUSTUS LEOPOLD (1816-63). British artist. Born in London May 2, 1816, he studied under Henry Sass and at the R.A. school, exhibited for the first time in 1838, became an A.R.A. in 1848, and R.A. in 1860. A subject painter, his best works include *Queen Elizabeth Discovers She is No Longer Young*, 1848; *Peter the Great Sees Catherine for the First Time*, 1850; and *The Night Before Naseby*, 1859. He died at Algiers, March 26, 1863. See Dickens illus.

Egga. Town of central Nigeria (Northern province). It stands on the right bank of the Niger, a few miles above Baro, the terminus of the Baro-Kano rly. It is the commercial outlet of the Gando country. Pop. about 10,000.

Eggar Moth (family *Lasiocampidae*). Name given to certain moths of moderate to large size



Eggar Moth. Example of small eggar moth, *Eriogaster lanestris*

whose caterpillars spin rather egg-like cocoons. Four species are British.

Eggishorn. Mountain of the Bernese Oberland, Switzerland, in the canton of Valais. It is the loftiest peak of the ridge separating the Aletsch Glacier from the Rhône Valley. Alt. 9,625 ft. On its S.E. slope is the Jungfrau-Eggishorn Hotel, at an alt. of 7,195 ft.

Egg Plant (*Solanum melongena*). Herb of the family Solanaceae. The leaves are oval, lobed, and woolly beneath; the flowers are similar to those of the tomato, white, yellow, or purple. The fruit,

a berry as large as a goose's egg, is white or purple. The fruit is edible, and the herb is largely grown for food. It is also called aubergine, brinjal, Jew's apple, rind apple.

Egham. Urban dist. and parish of Surrey, England. It stands on the Thames, 21 m. by railway W.S.W. of London. Near



Egg Plant. Specimen of the herb, showing leaves, flower, and berries

by are the Royal Holloway College, at Englefield Green, which provides advanced education for 250 women, and Holloway Sanatorium, a large asylum for the mentally deficient, opened 1885. Pop. (1951) 24,690. The meadows of Runnymede (q.v.) lie within the urban dist.

Egin or Ekim. Town of Asiatic Turkey, in the vilayet of Erzurum. It stands at an alt. of 3,300 ft. on the right bank of the Kara Su or Western Euphrates, 140 m. S.W. of Trabzon. Founded in the 11th



Egmont. The snow-capped cone of an extinct volcano of North Island, New Zealand

century by Armenian settlers from Van, it was the scene of massacres of Armenians, 1895-96. The houses are built as terraces and the streets are ladders cut into the rock. Fruit, wine, and cotton are produced. Pop. 23,000.

Eglantine. Name applied by the earlier poets, notably Chaucer, Spenser, and Shakespeare, to the sweet briar (*Rosa rubiginosa*). In Milton it probably refers to the honeysuckle (*Lonicera periclymenum*), still called eglantine in parts of Yorkshire. See Sweet Briar.

Eglinton. Village of Ayrshire, Scotland, in the parish of Kilwinning. It is chiefly notable for its castle, a seat of the earl of Eglinton and Winton. This is a building dating from 1798 but modelled on the baronial castles with towers and a keep. The village is on a coalfield, and near are large ironworks and coal mines.

Eglinton. Village of co. Londonderry, N. Ireland. Situated 10 m. E.N.E. of Londonderry, it is on the main Belfast road and has a railway station. During the Second Great War a large aerodrome was built from which air cover was provided for the Atlantic convoys. This was later taken over by the U.S.A.A.F. Pop. of village, 850.

Eglinton Tournament. Revival of the medieval tournament by the 13th earl of Eglinton, Ayrshire, held at Eglinton Castle. Aug. 28, 1839. The week's pageant was entirely spoiled by rain. Arrayed in complete suits of armour and representing characters in chivalry, some 15 knights tilted in ancient fashion, breaking their spears in the jousts and finally paying their devoirs to the queen of beauty, Lady Seymour, afterwards duchess of Somerset.

Egmont. Cone of an extinct volcano, North Island, New

Zealand. It rises from the Taranaki plain to a height of 8,260 ft. It is perpetually covered with snow, and is a well-known land-mark for sailors.

Egmont, LAMORAL, COUNT OF (1522-68). Flemish soldier and politician. Younger son of John IV, Count of Egmont, he was born at Hainault, Nov. 18,

1522. He served in the Algerian expedition of Charles V, and married a sister of the elector palatine. He acted as emissary between Philip of Spain and Mary of England, attending their wedding ceremony. His charge against the French at St. Quentin, 1557, and a brilliant victory at Gravelines, 1558, made him the hero of Flanders, and he was appointed governor of that province by Philip. Egmont protested against the Spanish administration, but refused to join the conspiracy of Flemish nobles in 1566; nevertheless, he incurred the enmity of Alva, regent of the Netherlands, was imprisoned at Ghent, condemned by the notorious Council of Blood, and beheaded, together with Count Horn, in Brussels, June 5, 1568.

The execution of these leaders is usually taken to mark the beginning of the revolt of the Netherlands. In 1865 a monument to Egmont was erected on the site of his death. His closing years are the subject of Goethe's great and popular tragedy (1788). To this work Beethoven wrote incidental music (op. 84) in 1810; the overture continues to be played at orchestral concerts.

Ego (Lat. *I*). Term employed generally in psychology to mean either the self or that side of the self which is governed by the instinct of self-preservation. By Freud it is used for that portion of the mind which receives knowledge of the external world through the senses, is capable of reasoning, can be directly modified by experience, and initiates direct voluntary responses to stimuli. The ego is distinguished from the id and the super-ego and in a satisfactorily adjusted person controls the activities of both by means of reason.

Egoism (Lat. *ego*, *I*). In philosophy, the theory that only "I" exists, and that everything else is

only an idea of this "I." This is now more commonly called solipsism (*solus*, alone; *ipse*, self). Egoism is more generally understood as the theory of self-interest, which leads a person to act with a view to securing pleasure and advantage for himself without any consideration for others. Egotism, as distinct from egoism, is thinking or telling too much about oneself.

Egoist, THE. Novel by George Meredith (*q.v.*), published in 1879. If not great as a story it is yet one of Meredith's greatest prose works. In the central character, Sir Wiloughby Patterne, is presented a remorseless delineation of egoism fostered by circumstance.

Egremont. Market town of Cumberland, England. It stands on the Ehen, 8 m. S.W. of Ennerdale, 5 m. S.E. of Whitehaven, and close to the Irish Sea. An ancient town, Egremont was a parl. bor. in the reign of Edward I, and has ruins of a 12th century castle. Iron ore is mined and limestone quarried. Market day, Sat. Pop. 6,000. Another Egremont, in Cheshire, is a N.W. suburb of Birkenhead.

Egremont, EARL OF. British title borne by the family of Wyndham from 1750 to 1845. It was

first a subsidiary title of the 7th duke of Somerset, Algernon Seymour, for whom it was created in 1749. From him it passed, in 1750, by special arrangement, to his nephew, Sir

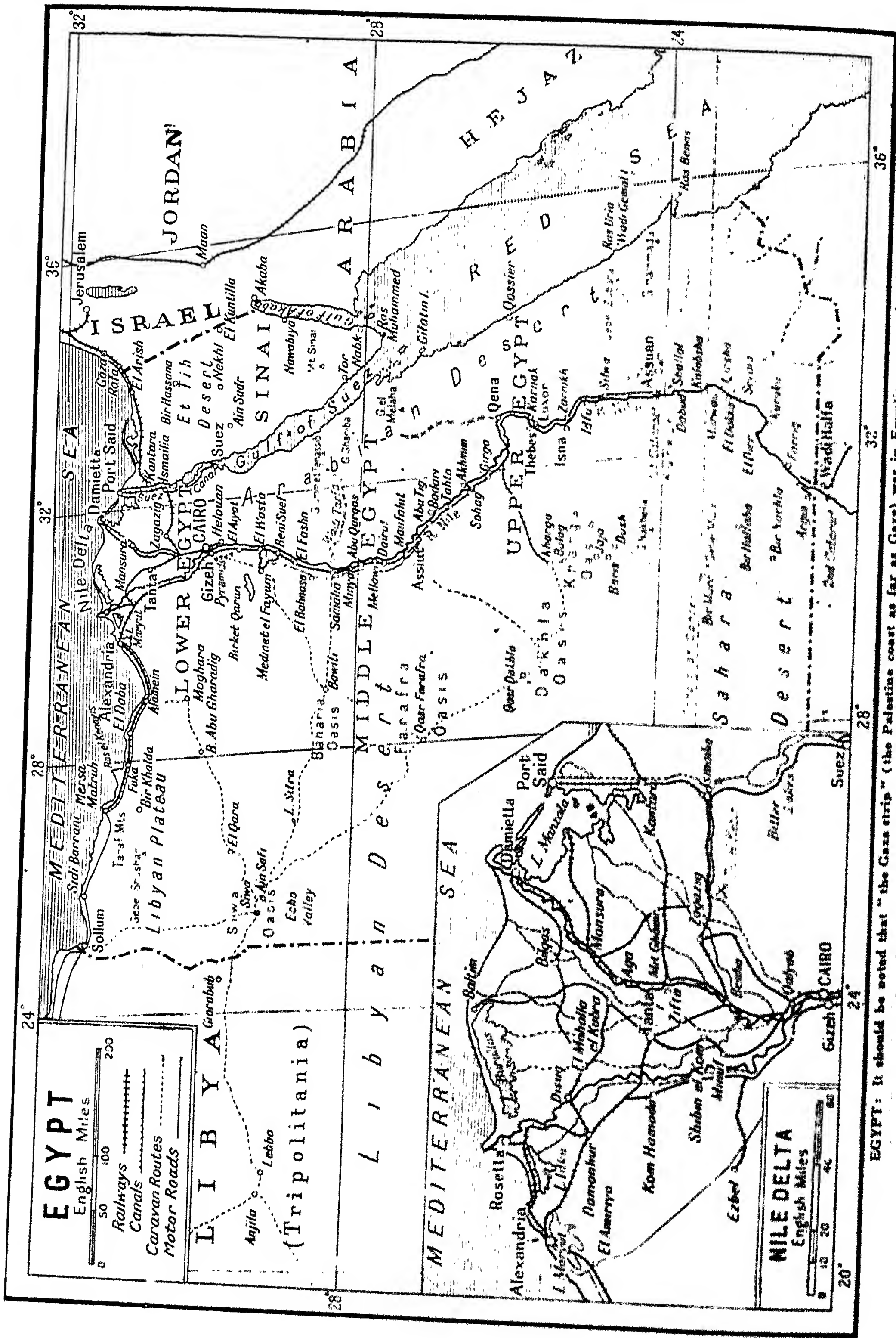


Egremont
After T. Phillips, R.A.

Charles Wyndham (1710-63), who was secretary of state, 1761-63. The 3rd earl, George O'Brien Wyndham (1751-1837), made Petworth, his Sussex residence, noted for hospitality. When he died he left his estates to his natural son, George Wyndham, who was made Baron Leconfield in 1859. The title earl of Egremont passed to a nephew, and became extinct on his death in 1845.

Egret. Name applied to several species of small white herons, of which the little egret is one of the best known. It occurs rarely in Great Britain; but is common in S. Europe and many parts of Asia and Africa. See Aigrette.

Egri Palanka. Town of Yugoslavia. It is on the high road from Uskub (Skoplje) to the Bulgarian frontier, and on the Pcinja. It is both a trade and strategic centre.



EGYPT: IN ANCIENT AND MODERN TIMES

M. S. DROWER, Lecturer in Ancient History, University College, London, and IRENE CLEPHANE

This article is divided into two main sections. The first describes the wonderful civilization which grew up in Egypt in the earliest days of recorded history, as revealed through archaeology. The second gives a concise account of modern Egypt, especially since the granting of independence in 1920. See also Pyramids ; Dendera ; Karnak, etc., and articles on the various rulers of Egypt ; Alexandria ; Cairo ; Nile ; Suez Canal, etc.

With its unique climate combining tropical sunshine and cool winds, and its extreme fertility, due to the annual flooding of the valley by the mud-laden Nile, Egypt has played a leading rôle in the history of Man. The necessity of controlling irrigation throughout the length of the land led to its early political unification; material prosperity followed, and the advantage of having excellent building stone everywhere within easy reach of water transport, together with the necessary cessation of agricultural work for a third of the year, provided the most favourable conditions for the development of architecture; art and industry flourished under royal patronage, and Egyptian ideas, with the products of Egyptian craftsmanship, were exported to Phoenicia and the Aegean, and had their influence upon the civilizations of Greece and Rome, and thence upon that of today. Moreover, the extreme dryness of the country has led to the wonderful preservation of even the frailest materials, and modern research, aided by a scientific technique of archaeology, has been able to reconstruct, in more completeness and detail than in any other country, the continuous story of human development from the earliest times.

Monuments of Antiquity

The antiquity of Egyptian civilization has never been in doubt, since standing remains of Egyptian monuments, pyramids, and temples, have been visited and described by travellers throughout the ages. It was not until the turn of the 19th century, however, that the scientific recording of Egyptian antiquities was begun, and the deciphering of the hieroglyphic writing by Thomas Young, J.-F. Champollion, and Samuel Birch, helped by the discovery of bilinguals such as the Rosetta Stone, led to rapid advances in Egyptology. The Boulak museum in Cairo, under the direction of Mariette Pasha and Sir Gaston Maspero (*qq.v.*), housed the treasures which year by year were unearthed by excavation; in 1881 the sensational discovery of the mummies of most of the New Kingdom pharaohs, bundled to-

gether in one pit for safety during the 12th century B.C. when their tombs were rifled, led to the further exploration of the royal tombs of the Theban necropolis, a footnote to which was provided by the belated discovery in 1922 of the only intact royal burial, that of Tutankhamen (*q.v.*); his tomb, though small, was packed with treasures the safe removal of which was superintended by the discoverer Howard Carter (*q.v.*).

Meanwhile the science of archaeology had made great strides. The dismantling and recording of buried sites with a careful regard for stratification, a method evolved by Sir Flinders Petrie (*q.v.*) in the last decades of the 19th century, set a new standard in the preservation of historical data as well as *objets d'art*; the noting of humble and hitherto ignored objects, such as broken pottery and stone fragments, made it possible to date a cemetery or building in the absence of inscriptions, and the sequence of prehistoric cultures in Egypt was gradually reconstructed. At Tell el-Amarna a brilliant phase of Egyptian civilization was discovered, though all traces of it had been expunged from the official records. Excavations in all parts of Egypt (except in the delta, where digging in the waterlogged soil is generally impossible) have made possible the tracing of the development of material culture from Neolithic to Roman times, and ample evidence of the imperial expansion of Egypt has

been found in the Sudan, in Sinai, and even in Palestine and distant Syria. Most of the extant monuments of Egypt have been recorded, some of them by beautiful and detailed reproductions in colour.

In the philological field, scholars have produced dictionaries and grammars of the Egyptian language in its several phases, and have published some thousands of texts; besides monumental inscriptions, these include papyri in hieratic and demotic (*see p. 2963*) comprising historical, literary, and religious texts, scientific and mathematical treatises, legal documents, letters, accounts, and inventories, which give a wealth of detail on the social and economic life of the people as well as an outline of their political history. (*See also Egyptology.*)

Remains of Palaeolithic Man

As the sea level gradually fell during the last Ice Age, primitive man began to descend from the high land which borders the Nile valley. The flint implements of Palaeolithic Man are found successively lower on the cliffs, while Neolithic settlements were established on what is now the "low desert" between the present limits of cultivation and the desert plateau. On the borders of Lake Fayum they fished, hunted, grew wheat, and domesticated animals. Their tools were of flint, their garments of skin and coarse linen; they made primitive clay pots but were skilled in basketry. Later phases of Egyptian prehistory saw an advance in the techniques of civilization; finely burnished pots with a combed decoration, ivory hair-combs and figurines, and carved stone palettes for grinding eyepaint are found in the graves of Upper Egypt, and the working of metal was begun.

The first metal tools were of hammered native copper, but in the succeeding phases of civilization, known to some archaeologists as Negada I and II, the arts of smelting and casting were discovered, and metal knives began to supplant the beautifully worked flint blades. Pottery was skilfully hand-made and ornamented first by white paint



Egypt. Pre-dynastic warrior, from a slate palette
British Museum

designs on a burnished red ground, later by scenes of boats in a riverine landscape, in red paint on buff ware. Stone-working received an impetus from the introduction of the copper drill, and slate palettes were sometimes ornamented with scenes of animals and men in fine relief. Beads and amulets were fashioned in stone, shell, and faience, and wood and ivory were carved.

HISTORICAL BEGINNINGS. The invention of writing, one of the most important steps taken by Man, occurred about the same time as these striking advances in material civilization. From tentative beginnings which are lost, the Egyptians soon developed their hieroglyphic system, and the beginning of written history seems to coincide with the period of the unification of the country under one ruler, the half-legendary Menes, to whom later ages ascribed the founding of Memphis and the beginning of the 1st dynasty. In the Vth dynasty the Egyptians set up an engraved annal known today as the Palermo Stone, stating the main event of each year and giving the height of the Nile, from the beginning of the 1st dynasty. Continuous records were kept; there are fragments of them in the XIXth dynasty papyrus, partly preserved in Turin, giving a list of the kings of Egypt with the length of their reigns in years, months, and days, and lists of kings from the walls of a XIXth-dynasty temple at Abydos and a tomb at Sakkara. There are also transcripts of a Greek version of Egyptian history compiled by the Ptolemaic priest Manetho (*q.v.*), which, though marred by corruptions, gives a consecutive record arranged in dynasties.

Dating Events of Ancient Egypt

The chronology can be reconstructed at least as far back as the XIIth dynasty, thanks to ancient Egyptian observations of the rising of the Dog Star, which once in 1,460 years coincided with sunrise on New Year's Day; for the earlier periods, it is necessary to depend on conjectures as to the date of the introduction of the solar calendar, and consequently all dates must be regarded as approximate only. The Archaic period of the first two dynasties may have begun about 3200 B.C. The cenotaphs of some of these kings have been found at Abydos, though they may have been buried at Sakkara, the Memphite burial ground, where magnificent brick "mastaba" tombs with rich funerary equip-

ment have been found. (*See* Mastaba; Menes; Sakkara.)

THE OLD KINGDOM (*c.* 2780-2240 B.C.). In the IIIrd dynasty, great technical progress was made. Massive stone pyramids replaced the royal mastabas, and mastery of the mason's craft made possible the beautiful white limestone funerary temple of King Zoser and the Step Pyramid to which it was attached, both possibly the work of the wise architect Imhotep whose fame lasted till classical times. Zoser's mining expedition to Sinai, and the voyage of King Sneferu's ships to the Lebanon, led to a regular commerce in copper and timber with these regions and Egyptian rulers were virtually in control of Byblos, the timber port north of Beirut. Sneferu, the first pharaoh of the IVth dynasty, was followed by the great trio, Khufu (*q.v.*), Khafra (*q.v.*), and Menkaura, whose mighty pyramids at Gizeh, with the sphinx and temples that complete them, bear witness to the vast wealth and resources of their builders.

During the Vth and VIth dynasties, the royal power declined. The Vth dynasty were upstarts from Heliopolis; devoted to the worship of the sun-god Ra, and dependent on a new nobility for support, they dissipated their means and lost control of provincial administration. The long reign of the centenarian Pepi II, who came to the throne at the age of six, was disastrous; governors of the southern districts set up independent dynasties, and some even assumed royal titles. The so-called First Intermediate period was a time of anarchy and divided rule; Herakleopolis was for a time the leading city, but a new Theban family, the Mentuhoteps, as the XIth dynasty, gradually succeeded in conquering the north and reuniting the land.

THE MIDDLE KINGDOM (*c.* 2160-1730 B.C.). This line of vigorous and able monarchs soon restored prosperity to Egypt; art and commerce flourished and craftsmanship reached its highest perfection. The Amenemhats and Senuserts of the XIIth dynasty showed especial interest in the development of the Fayum; the capital moved thither from Thebes, thousands of acres were reclaimed from Lake Moeris, and the great Labyrinth, where taxes were stored, was remembered with awe till Herodotus's day. The other great achievement of the XIIth dynasty was the conquest of

Nubia as far as the 2nd cataract, where frontier forts were erected; its control secured the safe passage of caravans from the Sudan and the working of the gold mines. But Senusert III and Amenemhat III were followed by less able administrators; central control was lost, and in the period of confusion following the XIIIth dynasty, the so-called Second Intermediate period, foreigners gained control of at least the northern part of the country. The Hyksos, a line of Asiatic origin, were later held in fear and loathing by the Egyptians, their monuments were destroyed, and little trace remains of a domination which may have lasted for nearly 200 years.

Theban Princes Restored

At length Theban princes again proclaimed themselves the champions of Egypt and drove out the Asiatics, reuniting the country under the rule of the XVIIIth dynasty. (*See* Amenemhat; Fayum; Hyksos; Senusert.)

THE NEW KINGDOM (1580-1090 B.C.). Egyptian armies now marched up into Syria, and a series of campaigns brought Thothmes I and III to the banks of the Euphrates. For a time, Egypt administered a considerable empire in Western Asia, tribute flowed into her treasuries, and the other great powers—Assyrian and Babylonian, Hurrian, Hittite, and Aegean—sought her alliance by rich presents and royal marriages. It was a cosmopolitan age. Foreign envoys and merchants brought to Egypt new wares, new fighting methods, new ideas, and the worship of new gods. Nubia, controlled by an Egyptian governor as far as the 5th cataract, produced greater wealth than ever before. Court luxury reached its apogee in the reign of Amenhotep III, called the Magnificent; enormous wealth was lavished on the building and embellishment of temples throughout the country, especially the great temples of the god Amon at Thebes, the capital. In *c.* 1370 B.C. a reaction against the power of the Amon priesthood split the country into factions; the heretic Amenhotep IV proclaimed the rival worship of the sun-disk Aten, moved with his queen Nefertiti to a new capital at Tell el-Amarna, changed his name to Akhnaton, and sought to erase the name of Amon wherever it might be found; but after his death the court returned to Thebes, Amon triumphed and redoubled his hold on the country's resources, and his power grew till one of his

high priests, at the end of the XXth dynasty, was able to seize the throne. Meanwhile the indifference of Amenhotep III and the preoccupations of his son had cost Egypt most of her possessions in Asia. Two pharaohs of the XIXth dynasty, Seti I and Rameses II, sought to win them back, but were confronted by a strong Hittite confederation, and a treaty at length set the frontier south of the Lebanon. In the course of his long reign Rameses II indulged his taste for the colossal in buildings such as the Ramesseum and the rock temple of Abu Simbel. His son Merenptah had to face threats of invasion from Libya, and in the XXth dynasty "peoples of the sea" from Asia Minor and the Aegean actually reached the borders of Egypt; Rameses III's defeat of them by land and sea is commemorated in his Medinet Habu temple. (See Akhnaton; Amenhotep; Hittites; Karnak; Rameses; Tell el-Amarna; Thothmes.)

Divided rule now weakened the country. Libyan chieftains long established in the western delta assumed royal titles and ruled from Tanis, maintaining good relations with the Theban hierarchy by intermarriage. Then in about 730 B.C. a new line of able foreign conquerors, this time from Napata in the extreme south, took possession of Egypt. Aspiring to win back the Asiatic empire of the great pharaohs of yore, these Ethiopians of the XXVth dynasty, Shabaka, Shebitku, and Taharqa, goaded the growing might of Assyria by constant interference in Palestine. Sennacherib's plan to invade Egypt failed; but Esarhaddon in 671 B.C. captured Memphis and for a time Assyrian soldiers garrisoned Thebes. They could not maintain their hold; not many years after, Psammetichus of Sais led a successful revolt and Egypt again enjoyed native rule. (See Napata; Taharqa; Tanis.)

THE SAITE RENAISSANCE AND PERSIAN RULE (663-525 B.C.). A nationalist revival under the Saites produced a nostalgic archaism, a return to the ideals of the Old and Middle Kingdoms in life and art. Egypt even regained some of her lost influence in international affairs; Necho for a time held part of Phoenicia and Palestine, Lydia and Samos were in friendly alliance, and the Greek colony at Naucratis brought Aegean trade to the mouths of the Nile. But this Indian summer could not last. The Persians,



Egypt. Rameses II, as a young man
Turin Museum

masters of the Median and Babylonian empires, inevitably turned towards Egypt. The conqueror Cambyses was followed by the administrator Darius whose interest in his Egyptian satrapy is seen in his building of temples and conciliation of the priesthood. Under Persian rule, Egypt seems to have prospered; she sent richer tribute to Ecbatana annually than any other province. (See Apries; Persia.)

THE PTOLEMYS (323 B.C. to A.D. 31). The invasion of Egypt by Alexander the Great in 332 B.C. was unopposed by the Persian satrap; on his death Egypt passed to one of his generals, Ptolemy son of Lagus, who in 305 assumed royal titles. The history of the succeeding century is chiefly that of the tripartite struggle between the Ptolemys, the Seleucid rulers of Syria, and the Antigonids of Macedon. A new city in the delta, Alexandria (*q.v.*), became one of the greatest centres of Hellenistic culture in the world; but on the whole Egypt retained its native character, its language and religion, with little change. Yet Egyptians had little say in the government of their country, and

the most fertile districts, such as the Fayum, became royal domains on which military settlements (*kleroi*) were established.

At first prosperous and powerful, the dynasty later declined into family intrigue and administrative apathy; a revolt under Ptolemy IV was suppressed, but the country continued in a constant state of unrest and came ever more under the influence of Rome, till in 31 B.C. the battle of Actium put an end to Cleopatra's ambition to restore the ancient glory of the pharaohs, and Egypt became a Roman province. (See Cleopatra; Ptolemy.)

ROMAN EGYPT. The peculiar status of Egypt in the Roman Empire was due to its importance, both as the gateway to the east and the granary of Italy. No senator might enter the province without permission, and it was governed by an equestrian prefect responsible directly to the emperor. Irrigation works increased the fertility of the land; heavy taxes in grain and money burdened the people. Hellenised town-dwellers received preferential treatment and alone could become civic magistrates. Late in the 1st century A.D. the custom arose of allotting the chief posts in local government, such as tax collector and chief of police, to qualified citizens in rotation; this liturgical system with its burdens and responsibilities became increasingly unpopular. Diocletian's reforms at the end of the 3rd century brought a re-organization of the administration and a new tax system which proved no better than the old and resulted in the growth of great estates owned by a wealthy few, to whom the majority of the people were bound in virtual serfdom.

Christianity spread early in Egypt, the home of asceticism and the monastic movement; the Arian controversy, which split the Byzantine empire, originated here, and in the 5th century, by embracing the Monophysite heresy, Egypt cut herself off from the Catholic world and pursued henceforward a strongly nationalistic line; the Coptic language tended to replace Greek in all but official circles.

SOCIAL ORGANIZATION. In the earliest period known to scholars, there seem to have been but two classes of Egyptian—the king and his nobles, and the fellahin or peasants who worked for them. In theory the pharaoh was the owner of all Egypt; kingship was divine, and the king had absolute

powers and privileges. In practice, though he kept all offices under his control, his powers were delegated more and more as the organization of the state increased in complexity: under him were the vizier, who was lord chief justice and had control of administration; the chancellor of the treasury, the army commander, and a host of other officials. The traditional division of the country into the two kingdoms of Upper and Lower Egypt, maintained in the royal titulary, was never lost sight of; in the New Kingdom, by the creation of a second vizier, the administration regained its dual character.

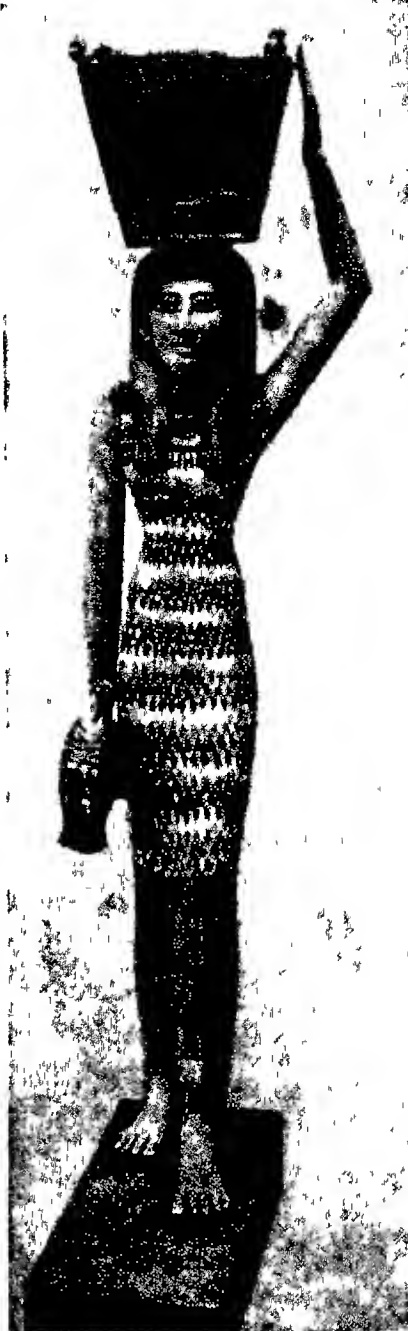
Nubia was governed by a viceroy with his own court and hierarchy of officials, while Egyptian possessions in Asia had native governors whose authority was strengthened by Egyptian garrisons and checked by frequent tours of inspection and demonstrations of military strength.

Egypt itself was divided into districts or nomes, of which there were 20 in Lower Egypt and 22 in Upper Egypt, each governed by a local prince or nomarch; at first these governors were closely attached to the court and their offices were in the king's gift, but at times when the royal power was weakened by dynastic dissension or foreign invasion, the office of nomarch tended to become hereditary, and powerful families, acquiring wider and wider estates, ruled as petty kings and even claimed the titles of royalty.

In the Middle Kingdom the king looked to a new element for support—the nascent middle class of craftsmen, scribes, and merchants who were not bound to the land or dependent on noble patronage. In the XVIIIth dynasty a further class grew up, that of the

professional soldiers, men who followed the Pharaohs on their campaigns, and served in garrisons at home and abroad. As time went on this standing army was composed less of Egyptian levies with their spears and axes, and more of mercenaries—Nubian and Libyan archers and the freebooters of the Aegean with their spiked helmets and broad-swords. The priests were a class apart, gradually increasing in numbers and wealth as more and more land was granted to the temples and prisoners of war and booty from the royal campaigns were dedicated to the gods whose service was their livelihood. It is estimated that the estates of the god Amon alone, in the XXth dynasty, occupied nearly $\frac{1}{3}$ of the cultivable land in the Nile valley. These estates were worked by the serfs, craftsmen, and fellahin of the temples, and yielded rich revenues.

FAUNA AND FLORA; AGRICULTURE. The Nile valley was bordered by papyrus swamps abounding in crocodile and hippopotamus, dangerous quarry for the Old Kingdom huntsman in his frail skiff of reeds; later, fowling with the throwstick was the popular nobleman's sport. On the high desert game abounded: oryx and antelope, the stag, hyena, and hare were hunted with the bow, or snared and fattened for the rich man's table. Dogs and cats (*see*



Egypt. Wooden tomb-model of a maidservant, about 2000 B.C.
Met. Mus., New York

plate 2, opp. p. 2965), cattle, sheep, and goats were domesticated from very early times; in the XVIIIth dynasty the introduction of the horse from Asia provided an animal for riding and driving by the wealthy few, and the donkey continued to be the only beast of burden till the introduction of the camel in Roman times.

Wheat, barley, and spelt were the staple crops and in a good year the harvest yielded sevenfold. "Egypt is the Nile," and the fertility of the land depends absolutely on irrigation and the annual flooding of the Nile valley. The rise of the river in early summer, measured by the Nilometer, was watched with anxiety; dykes were strengthened if the flood threatened to be abnormally high.

Distribution of corn reserves was organized when there was a drought. Flax was grown for linen cloth, and all kinds of vegetables and fruits; bee keeping provided honey and wax, and papyrus (*q.v.*), harvested in bundles, cut in strips and dried, was made into ropes, slipper-soles, and other things, as well as the sheets of writing material that formed an important export to the classical world.

Fish, both fresh and dried, was eaten by the layman though forbidden to priests, and a variety of cakes and loaves was baked in ovens similar to those used today. Beer was a common drink, and viticulture was extensively practised; the best Egyptian wines, grown in the western oases and in the delta, were exported during the Roman period.

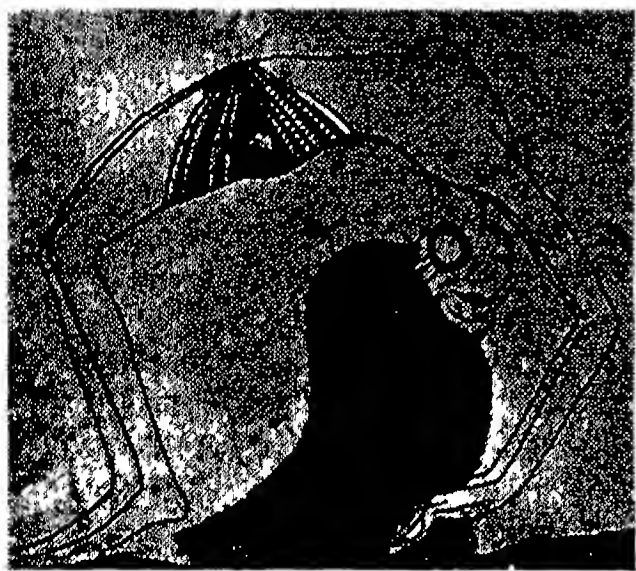
DRESS AND TEXTILES. The dress of an Egyptian of the Old Kingdom was a short crossover linen skirt from navel to knee, knotted in front. Women wore long white tunics with shoulder straps or tight short sleeves. Later more elaborate draped robes of pleated linen became fashionable for both sexes. Libyans, Nubians, and Syrians resident in Egypt wore brightly patterned woollen tunics, but the white-clad native Egyptian



Egypt. Peasants irrigating a garden with "shadufs," similar to those in use today

relied for colour rather on brilliant ornaments, necklaces, pectorals, or bracelets of gold and semi-precious stones, and wide collars of coloured faience, until coloured clothes became fashionable in the Roman period. Men's hair was at first cut short and worn straight, but in the New Kingdom elaborate wigs reaching to the shoulders were the mode, and continued until the late period. Priests had shaven heads, and women's fashions seem to have varied as much then as now. Cloth of a remarkable fineness was woven on simple looms; leather was used for defensive armour and labourers' jerkins, as well as for furniture in the houses of the rich and for many other domestic objects.

Music and dancing were favourite pastimes; the wealthy were entertained at banquets by musicians playing several kinds of



Egypt. Girl acrobat turning a somersault, a picture reproduced from a painting on a sherd of the XIXth dynasty

harp, lutes, flutes, and castanets or drums, sometimes as an accompaniment to singing, sometimes in a small orchestra, or by lightly clad dancing girls, or acrobats and jugglers. Old Kingdom reliefs



Egypt. Reconstruction of a typical house of a well-to-do Egyptian at Tell el-Amarna. Below is the north hall; above, the clerestory central hall

Egyptian Exploration Society

show a kind of chorus spinning and high-kicking to the accompaniment of rhythmic singing and clapping.

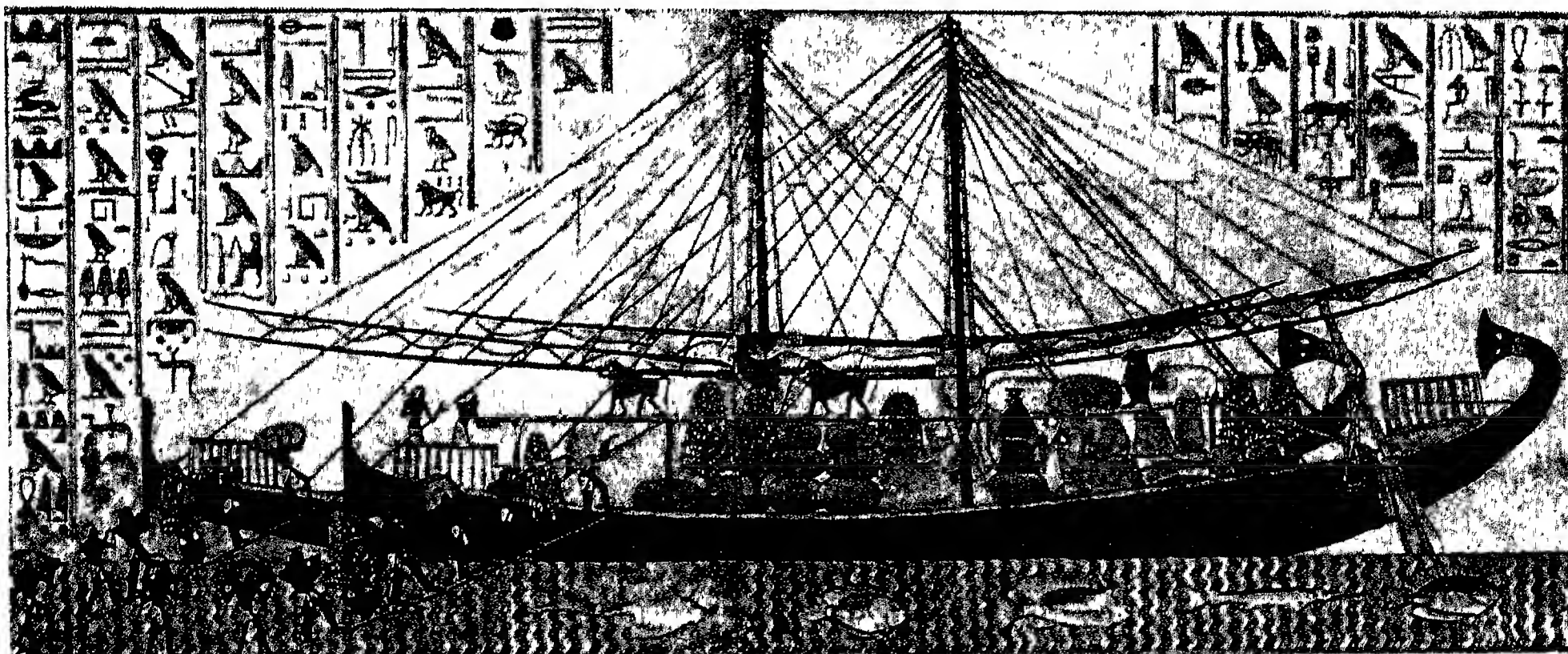
The Ships of Ancient Egypt

The primitive reed float of the predynastic Egyptians was used at all times for fishing and fowling, but for river freight and ocean voyages ships soon began to be built of wood. Clinker built with transverse ribs, a typical sea-going craft had a deck with cabins, a double mast, which could be lowered to the deck, carrying an oblong sail, and a gunwale to protect crew and merchandise. The crew might consist of 15 pairs of oarsmen, and the ship was steered by two great paddles at the stern.

Such boats managed considerable voyages from very early times: in the Old Kingdom maritime trade flourished with Byblos, the port for Lebanon

timber, a commodity vital to the Egyptians whose trees provided no long spars. Trading ships starting from Kosseir (Qoseir) on the Red Sea coast carried Egyptians to southern Arabia or the Somaliland coast (the ancient Punt) for the luxury products of inner Africa, myrrh and gold, ebony and ivory, panther-skins and ostrich feathers. By land, mining expeditions went constantly to Sinai for copper and to Nubia for gold; neighbouring Asiatic states sent their manufactures to pharaoh—vessels of gold and silver, inlaid furniture and chariots, silver and precious stones—in return for Nubian gold.

ARCHITECTURE AND ART. Egyptian architecture had its beginnings, like the land itself, in the fine alluvial mud of the Nile. The earliest dwellings, like those of villagers to this day, were of mud and reed matting,



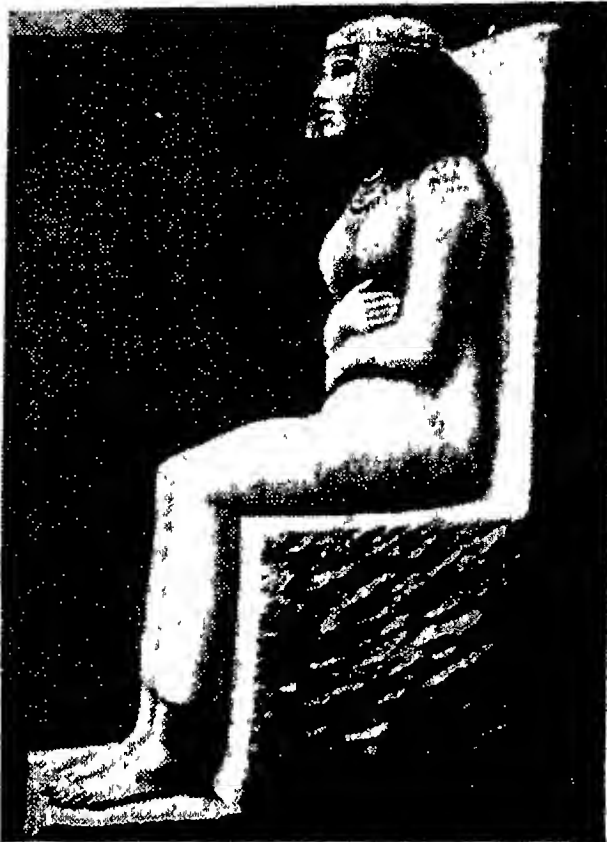
Egypt. Sea-going ships belonging to Queen Hatshepsut taking on board produce of Punt (modern Somaliland) for transport to Thebes

Egyptian Exploration Society

and the typical Egyptian house at all periods was of plastered mud-brick. Its plan was simple—an enclosed courtyard with one or perhaps two living rooms behind, and steps to the flat roof on which the family slept in summer. The houses of the wealthy were more elaborate, with inner courts, bathrooms and lavatories, harem quarters for the women, and separate servants' buildings with kitchens, granaries, and bakehouses. The central living rooms were lit by clerestory windows and decorated with frescoes.

But mud-brick is not a lasting material, and Egypt is rich in all kinds of stone—a fine white limestone in the north, and sandstone in the south, as well as red granite, quartzite, alabaster, and other ornamental stones. When therefore the ancient pharaohs sought to provide a more permanent house for their gods, and a safer tomb for their bodies, they built in stone, at first imitating in that material the architectural forms of brick and reed construction—as is clearly to be seen in the first considerable stone building in Egypt, the beautiful limestone temple of King Zoser (IIIrd dynasty) at Sakkara—but soon using massive blocks and freestanding pillars such as the granite monoliths of the Valley Temple of Khafra at Gizeh (IVth dynasty). The simple mud-pile marking the tomb developed into a large oblong, bench-shaped superstructure of brick with panelled walls, called by modern Egyptians a "mastaba"; the massive solidity of the stone pyramid, in the heart of which the pharaoh was buried, may be an elaboration of this.

From the simple god's house with courtyard and sanctuary,



Egypt. Statue of the Lady Nefert (Old Kingdom)

the temple became a complicated structure which never, however, lost its basic plan. A typical Egyptian temple of the New Kingdom was approached through an avenue of sphinxes and a gateway flanked by pylons, high tapering walls decorated with scenes in relief showing pharaoh worshipping the gods, smiting his prisoners, or performing deeds of valour. A series of courtyards and pylons beyond led to a pillared, or hypostyle, hall, whence the worshipper passed into the darkness of the sanctuary where the statue of the god rested in a stone shrine, confronting the altars, offering stands, and other paraphernalia of his cult.

Behind and around lay priests' rooms and storerooms for the temple treasures. The temple walls were decorated with painted reliefs showing phases in the cult ritual, in order to ensure, by magical imitation, the perpetual performance of these successive acts of worship. A similar aim lay in the decoration of tombs with lively scenes of daily life, realistically drawn in the hope that the owner might enjoy in the next world the pleasures and comforts of his life on earth.

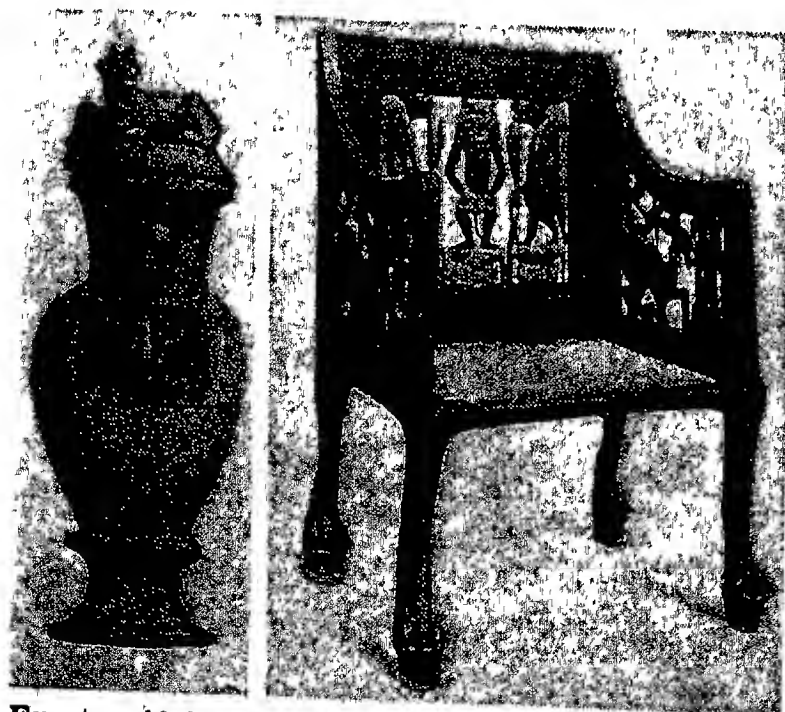
These reliefs were painted in bright colours, most of which have now disappeared revealing the delicacy of the modelling beneath; animals, plants, and human figures are rendered with a naturalism bounded only by conventions such as the representation of chest

and shoulders presented frontally while the hips and head are in profile. Sculpture in the round was similarly a blend of naturalism and convention; the canon of proportion between the various parts of the body was fixed, the poses permitted to a standing, sitting, or squatting figure were few, the eyes must look straight ahead and the left leg advance, yet the statues are often masterpieces of portraiture and needed in fact to be as exact a likeness as possible since they might be needed to replace the body in the tomb, or the worshipper in the presence of his god. The somewhat extreme naturalism of the Amarna period, when some of the conventions were abandoned, was unique in Egypt; with the overthrow of the Atenists, a return was made to the old traditions, and Egyptian art lost its inspiration. An abortive attempt at archaism in the Saite period was followed by the stiff infelicities of Ptolemaic art.

At all periods the masons and sculptors of Egypt showed a remarkable mastery of their material. The hardest stones, diorite and quartzite, porphyry and schist, were carved and polished; colossal statues 60 ft. high or tiny statuettes were made with equal success, and the hieroglyphic inscriptions and relief sculpture on monuments were executed with the finest detail and modelling.

Metal was worked with great skill; the techniques of hammering and casting copper and bronze made possible the manufacture of a lifesize statue or a tiny flask or figure, and by the *cire perdue* method, metal only $\frac{1}{16}$ in. thick could be cast. A ring handle playing loose in its loop attachment could be cast all in one. Gilding and filigree work, the decoration of jewelry with small soldered granules and with cloisonné work using tiny pieces of turquoise, cornelian, and lapis lazuli were all techniques practised by the Middle Kingdom goldsmiths, and in the XVIIIth dynasty a favourite process was the inlaying of one metal by another to form figures and scenes.

Glassmaking and the kindred craft of faience, in which a moulded quartz matrix is covered with glaze, were known from very early times, becoming especially popular in the XVIIIth dynasty when precious stones were imitated, and small vases were made of multi-coloured moulded glass. Blown



Egypt. Alabaster vase and carved chair from the tomb of Yuya and Tuya, 15th century B.C.
From Theodore Davis, *Tomb of Tuya*

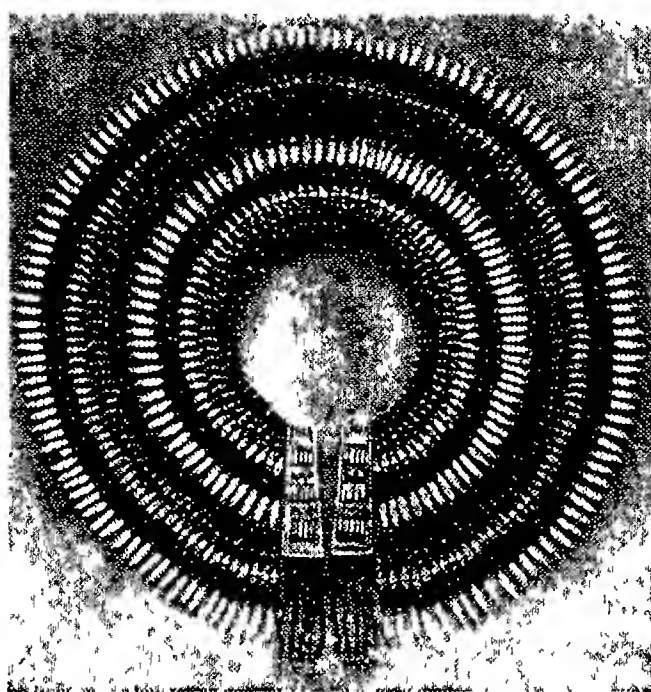
glass vessels are not known till the Roman period, when Alexandria became a great centre of glassmaking and intricate glass inlay and mosaic were popular.

ASTRONOMY AND MATHEMATICS. Ancient Egyptian science was applied to purely practical ends. Thus geometry developed, as its name implies, from a need to survey the area of fields, or to estimate the contents of a granary or the number of bricks needed to construct a ramp of a given size. Accurate observation and painstaking recording enabled the Egyptians to determine the position of stars and to set out the sides of a pyramid with an error of scarcely 1 in 10,000. A decimal system of numeration was early adopted. Division and multiplication were achieved by the rather clumsy method of successive halvings or doublings added together; thus 11×17 would be reckoned: $17 + 34 (68) + 136 = 187$.

A system of standard weights and measures was devised. Maps of the constellations were drawn and the year was divided into dekans, periods of 10 days each marked by the rising of a particular group of stars. The year was also divided by an agricultural calendar according to the seasons, and by a solar calendar which observed the heliacal rising of Sirius. Shadow clocks on the sundial principle and waterclocks, stone vessels with sloping graded sides and a hole in the base out of which the water ran, measured the hours of day and night.

A considerable knowledge of human anatomy was needed for mummification, and medical papyri for the diagnosis and treatment of various ills show some clinical understanding and the use of an extensive pharmacopeia, interlarded with quack remedies and magical spells.

WRITING AND LITERATURE. During the period immediately before the dynastic age, the ancient Egyptians evolved their peculiar system of hieroglyphic writing with its repertory of over 700 picture signs. These signs were



Egypt. Bead collar of King Tutankhamen. Pictures of other objects connected with this king follow page 8232

used ideographically to denote the objects they depicted, or phonetically to denote consonantal sounds similar to the names of those objects—thus a picture of a canal, *Mer*, was used in words such as *meri* “love” containing those consonants, and also after words denoting stretches of water such as “lake,” “river,” or “sea.” Most of these signs contained two or three consonants, but a few had only one, and the next logical step, namely the use of these uniconsonantal signs as an alphabet, was never taken by the Egyptians, and their clumsy and elaborate system remained in use till in its latest phase the Egyptian language was written with the Greek alphabet, with a few necessary additional native signs, when it became known as Coptic, the language which still survives in the liturgy of the Christian church in Egypt and Abyssinia. The elaborately-formed hieroglyphic signs, each often a little gem of formal decorative art when carved in stone and painted, acquired a cursive linear form known as hieratic when written in ink on wood or papyrus, or on pottery fragments called ostraka which were used for letters and accounts. Later a still more abbreviated form, demotic, was evolved. (See Ani; Hieroglyphs; Papyrus.)

The considerable body of Egyptian literature extant shows a great variety of form and expression.

Autobiographical inscriptions of private persons, royal annals, and official records are written with some descriptive power and a vivid, if limited, use of metaphor. Repetition and refrain in many hymns and prayers show that they were chanted or sung; love lyrics often contain passages of beauty. An extract from Akhnaton's hymn to the Sun, which has been compared with 104th psalm, may be translated:

Thou risest in beauty in the horizon of heaven,

O living Aten who createst life. When thou risest in the east, thou fillest every land with thy beauty.

Thou art beautiful, great and gleaming, high over every land.

Thy rays embrace all lands, to the limit of all thou hast made . . .

The whole earth doth work, the cattle graze in their pastures, The trees and herbage grow green, the birds fly up from their nests,

Their wings flap in praise of thy spirit,

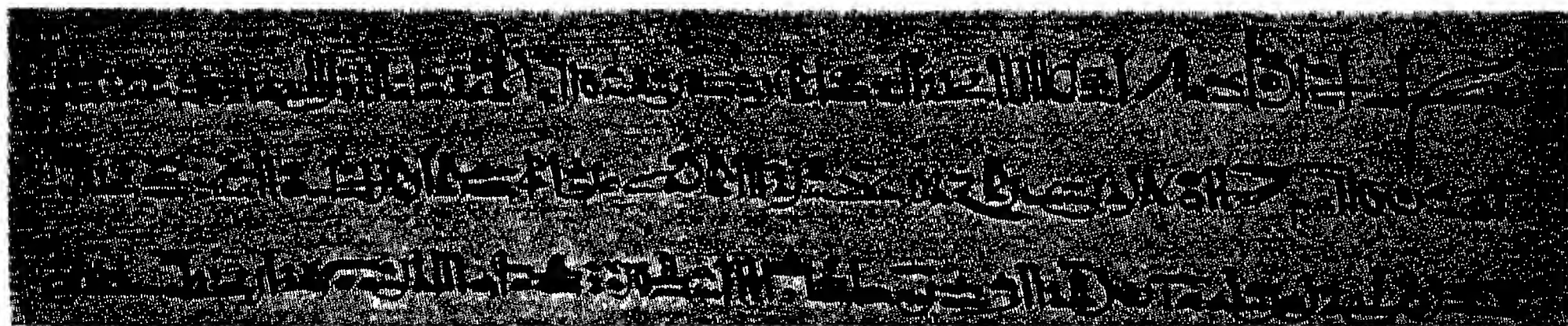
All goats jump on their feet, all flying and fluttering things live when thou hast shone upon them . . .

Tales of magic and adventure, often with a mythological or historical background, were popular; and model letters, maxims, and philosophical compositions, often of a highly moral tone, were copied in schools:

O scribe, be not idle, be not idle, or thou wilt be punished. Set not thy heart after pleasure, or thou wilt meet ruin. Write and read, and ask the advice of those who are wiser than thou.

A note of melancholy pervaded much of Egyptian literature; at feasts harpers would entertain the guests with songs in praise of death or on the theme, “Eat, drink, and be merry, for tomorrow we die.”

EGYPTIAN RELIGION. The gods of the Egyptians were diverse in nature and origin; some seem to have been originally astral bodies, others arose from totemic worship and had animal forms; yet others were vegetation deities connected



Egypt. Part of a page of hieratic writing from the great Harris papyrus
British Museum



Egypt. Vignette from a funerary papyrus showing the mummy of Hunefer embraced outside the temple by the god Anubis. Hunefer's wife and daughter weep before his mummy, and priests perform the last rites

with the cycle of the death and rebirth of the crops. Some were indigenous, others introduced from abroad. In a country where climate conserves all, nothing could be forgotten: the old primitive cosmology was preserved alongside new ideas and beliefs, and many apparent inconsistencies in Egyptian religion can thereby be explained.

The chief deities of the pantheon were originally local gods whose shrines rose to political importance and whose cult therefore took on a national significance. Ptah, god of Memphis, the early capital of Egypt, Ra of Heliopolis, Mentu of Hermonthis and Amon of Thebes, Thoth the Hermopolite, and Neith the ancient goddess of Sais were among these. As they became incorporated into a theological system, they were endowed with shapes and attributes and sometimes acquired a consort and offspring; the triad of Thebes for instance was Amon, Mut, and their son Khonsu. As well as in his human form, Amon was worshipped in his theophanies the ram, the goose, and the bull; Hathor had the form of a cow, Anubis the head of a jackal, Buto was a cobra, and Bastet a cat, while Thoth, the god of wisdom and the moon, appeared with the attributes of an ibis or a baboon.

The worship of sacred animals was especially popular in the late

period, when they were mummified and kept in catacombs (see Mummy; Serapeum). Other deities took on a more universal aspect. Osiris, whose worship was originally centred at Abydos, had a special sanctity as lord of the underworld, with whom men became identified after death; his consort Isis and his son, the hawk-god Horus, played a special rôle in the cycle of death and resurrection. Anubis presided over the rites of mummification. Hathor, goddess of love, was the patron of women, while in the hour of childbirth they turned to a grosser, more homely genius, the hippopotamus goddess Thoueris. Bes, the comic dwarf god with dancing feet and wagging tongue, was the children's favourite. (See Amon; Horus; Osiris, etc.)

An Egyptian temple was in essence the god's house, and daily rituals of getting the god up, dressing, washing, and feeding him, were performed by his priests. Great emphasis was set on purification; the temples were continually sprinkled and swept, the priests wore clean white linen and underwent constant lustrations. Offerings of bread and beer, fruit, vegetables, and roast meat were daily set before the god, and on feast days his statue would be carried in procession around the precincts decked in new robes and garlanded.

The king was in theory chief pontiff, and as such led the worship of the gods in every temple in the land on behalf of his people. In practice this was of course impossible, and the head of each priesthood stood proxy for the king in daily ceremonies and seasonal rites; the pharaoh himself was wont to preside at great festivals such as the annual feast at Abydos, where a passion play of the death and resurrection of Osiris was enacted, or the Beautiful Feast of Opet, the great festival of Amon at Luxor. A hierarchy of priests with graded duties—lectors, musicians, and magicians, and a staff of "purification priests" with humbler domestic tasks, were attached to each temple and served in rotation. Great estates were administered by the temples, with a full complement of agricultural labourers, artists, and craftsmen, and some of the greater priesthoods attained enormous wealth and power. Priestesses also served in the temples, especially in those of goddesses. The priestly schools, like medieval monasteries, were probably the only source of education.

Treatment of the Dead

From the earliest times, offerings were put in the graves of the dead to supply them with the necessities of this life, food and drink, tools, vessels, and weapons which they might need in the next world. The preservative qualities of the Egyptian soil and climate fostered belief in material survival, and attempts were early made to conserve the body and to ensure that the soul could reanimate it. As time went on mummification (see Embalming. Mummy) reached a high standard; after evisceration the body was steeped in natron, packed with stuffing, elaborately bandaged with amulets, prayers, and spells to assist the dead man in the hereafter, encased in cartonnage, and placed in a painted wooden coffin or a stone sarcophagus.

Lest these precautions should fail, a portrait likeness of the deceased was placed in his tomb, on whose walls he was depicted engaging in those earthly activities which he wished to enjoy in the life to come. Offerings of food and drink were brought to the tomb daily, and spells recited by the mortuary priest to ensure the revivification of the dead man and his tomb-pictures; a funerary endowment generally sought to ensure that all these

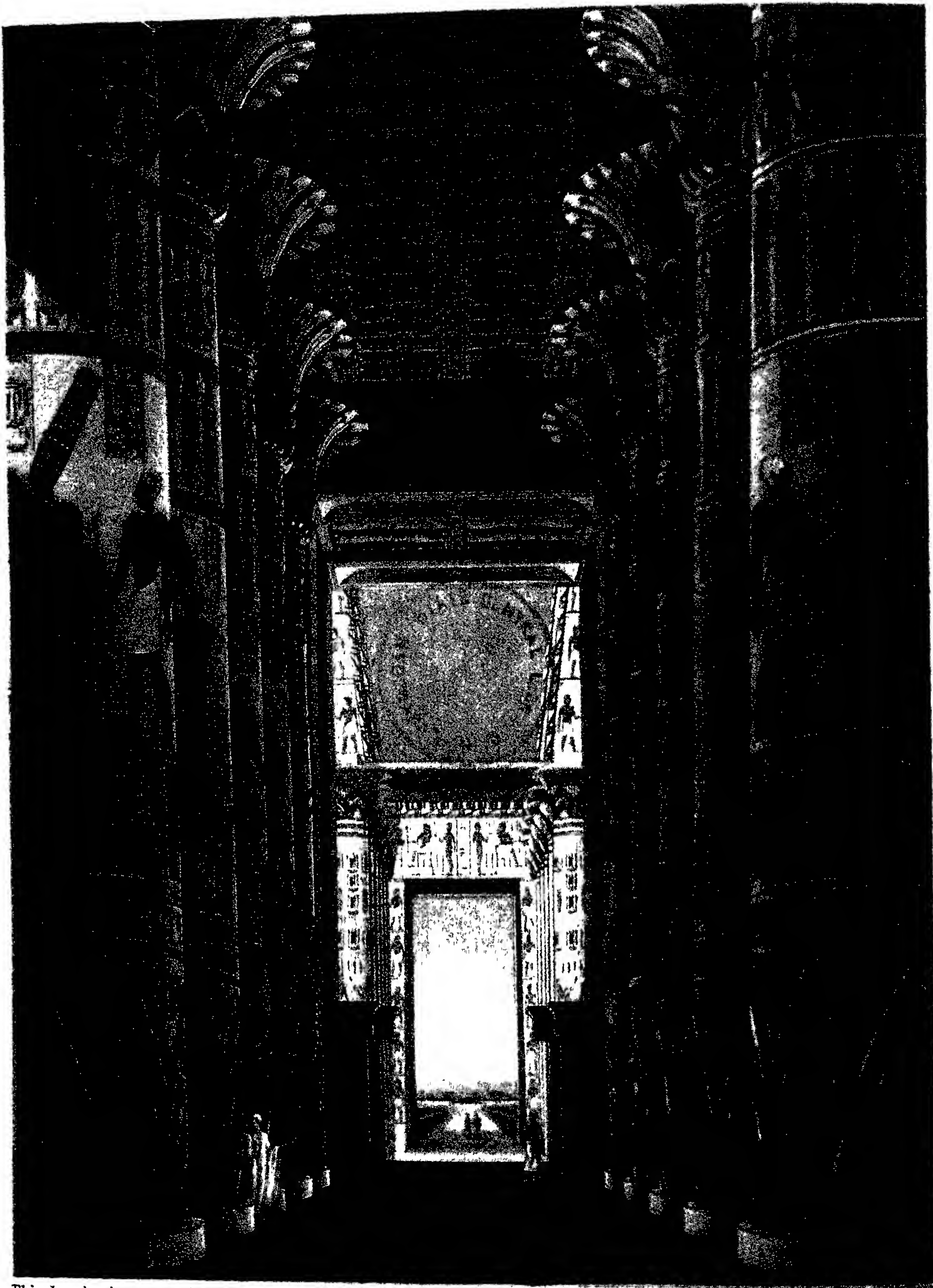


On the left are side and front views of the famous painted limestone head of Nefertiti, wife to the heretic pharaoh Amenhotep IV (ruled 1375-1358 B.C.). This was discovered in the workshop of the sculptor



Thothmes at Akhetaton and later found a home in the Berlin Museum. Right: the gorgeous anthropoid casket containing the mummy of Tutankhamen (died 1353 B.C.), who was the son-in-law of Amenhotep

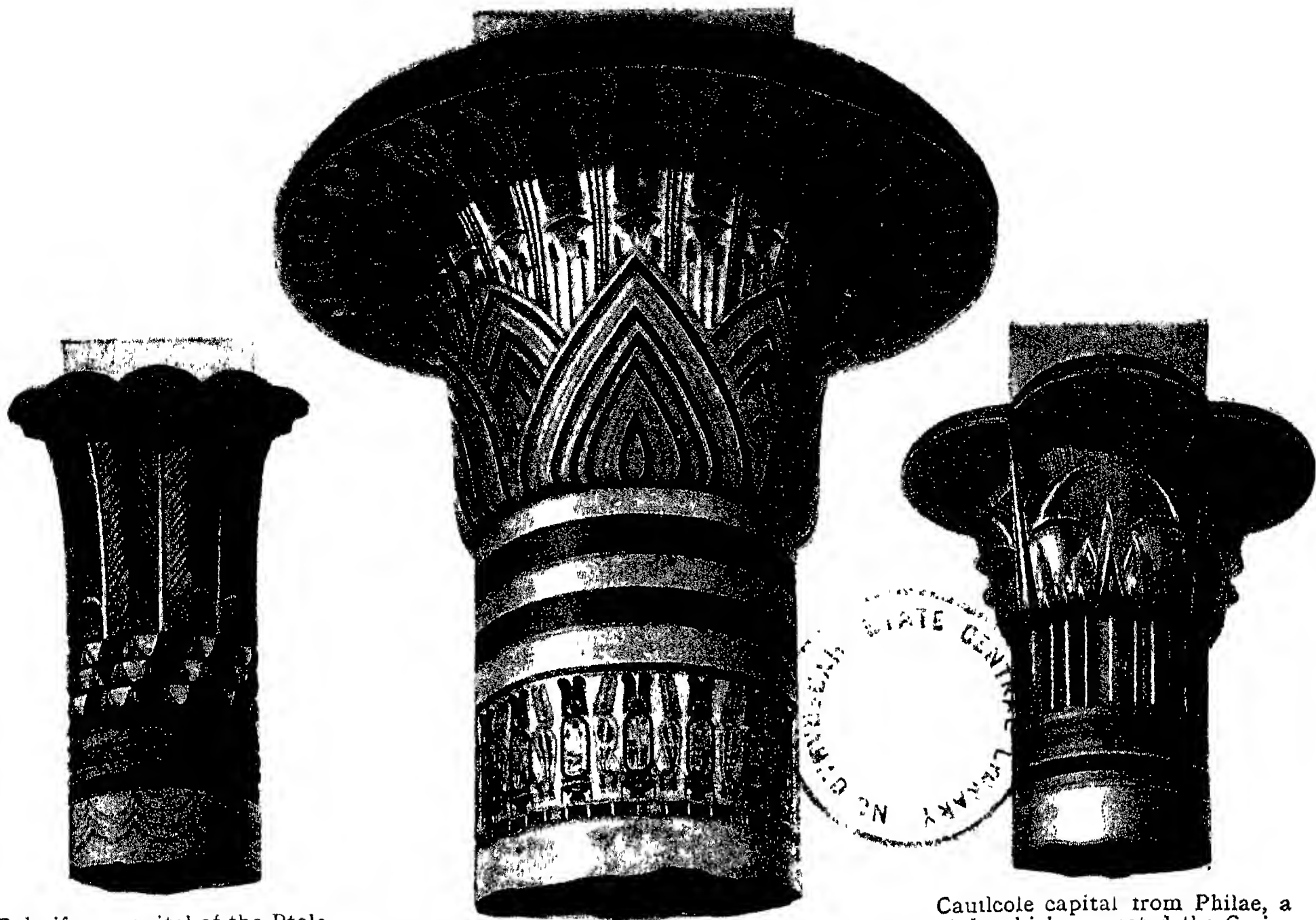
EGYPTIAN ART: PERFECTION IN SCULPTURE AND SPLENDOUR IN DESIGN



This drawing by a twentieth-century artist gives an idea of how the Hypostyle Hall (hall of columns) of the Great Temple of Ammon at Thebes (modern Karnak) must have looked when it was a centre of worship. The impressive dignity of the architecture is evident; while the brilliant Egyptian daylight beyond the doorway must have given added pleasantness to the shade within. Work on this temple went on from the Middle Empire to the Ptolemaic period—something like 2,000 years. Seti I began the Hypostyle Hall about 1310 B.C.; it was finished by his successor Rameses II some years later.

EGYPTIAN ART: THE SPLENDOUR OF ANCIENT THEBES

To back plate facing p. 2964



Palmiform capital of the Ptolemaic period, from the great temple of Isis, at Philae

Bell-shaped capital from the Hypostyle Hall, at Karnak; diameter at widest, 22 ft.

Caulcole capital from Philae, a style which suggested the Corinthian capital to the Greeks



Inscription from the tomb of Merab at Gizeh. Between the two figures of Merab, who, on the left, is accompanied by his mother, are seen subjects carrying baskets of wine, food, etc. The bottom two rows show the chief butcher followed by his assistants bearing a goose and a calf and cutting up an ox

EGYPTIAN ART: RICH ORNAMENT AND COLOURED INSCRIPTIONS OF AN ANCIENT CIVILIZATION



From the tomb of Khnumhotep: left, a redstart, two shrikes, and a dove in a flowering acacia, with ducks below. Right, an ibis on a papyrus plant. The ibis, held to be sacred, was once common in Egypt though now seldom encountered north of the Sudan



The dog on the left, of greyhound type, is probably the ancestor of the modern Nubian "slughi" hound; the bird, right, is a species of heron. The first is in the tomb of Amenemhet, while the second forms part of the great harpooning scene in the tomb of Khnumhotep



It is in the Middle Kingdom tombs at Beni Hasan, belonging to powerful local barons, that Egyptian wall painting reaches its highest development: the truth and vitality of the group of animals in this page speak for themselves. Immediately above is a cat (probably domestic) that has climbed a papyrus stem, from the tomb of Khnumhotep; while to the right is a grey-and-tan hound from the tomb of Khety

EGYPTIAN ART: REPRESENTATIONS OF ANIMALS FROM ANCIENT FRESCOES *From drawings by Howard Carter in Newberry, 'Beni Hasan,' Egypt Exploration Society*

services should be performed in perpetuity.

The wealth of equipment buried with a pharaoh, as exemplified by the splendid vessels, jewelry, and furniture buried with King Tutankhamen, ensured a future life of regal splendour; noblemen were buried with models of their servants performing menial tasks, such as brewing, baking, and cooking, for their masters, and sometimes a set of *ushabtiu*, "answerers," whose duty it should be to do heavy work in place of the dead man, should he be summoned to the corvée in the next world.

There were many ideas current about the nature of the hereafter and the fate of the soul after death. The pharaoh became Osiris; he sailed in the sun-boat through the twelve hours of night with the god Ra, and fought the demons of darkness. Later the Osirian hereafter became common to all, and every man expected after death to be called to the judgement hall before Osiris, where his heart was weighed in the balance, and, if loaded with sin, was cast to the Devourer of Souls. (See Ani, Papyrus of, illus.)

M. S. Drower

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MODERN EGYPT. The outstanding physical features of modern, as of ancient, Egypt are the Nile and the desert. Egypt (Arabic Misr) is bounded N. by the Mediterranean, N.E. by Israel (Palestine), E. by the Red Sea, S. by the Republic of Sudan, W. by Libya. The area of the country is about 385,000 sq. m., of which only 13,600 sq. m. is habitable. The country is divided into Lower, Middle, and Upper Egypt. Lower Egypt is the northern part—the delta of the Nile; Middle Egypt lies between Cairo and Assuan; Upper Egypt is the southern part—the middle Nile valley. The fertile portions of the country are in the delta, the Nile valley, and the oases. With continuing im-

provement in drainage and irrigation, the cultivable area increases yearly.

The majority of the people are fellahin (peasants), dependent upon the rich alluvial sediment brought down by the Nile from the mountains of Abyssinia, through the Atbara and the Blue Nile, and deposited upon the banks of the river in its annual overflow, converting desert sand into cultivable soil. In Upper Egypt, the Nile valley is narrower than in Lower, and the desert on either side is bounded by hills; here, as elsewhere, the valley lands are well cultivated.

The Nile enters Egypt proper at Wadi Halfa, just N. of the second cataract, flowing through a narrow valley as far as 25° N. The delta extends some 100 m. S. to N., and 155 m. along the shore of the Mediterranean between Alexandria on the W. and Port Said on the E. The whole of this area is watered by a network of waterways, natural and artificial, of which the chief are the Rosetta and Damietta branches of the Nile. The lagoons of the delta, Mariut, Edku, Burlus, and Menzala, are shallow with salt or brackish water; the largest is Menzala (about 780 sq. m.).

The desert plateaux extend on either side of the Nile valley from the S. borders of Egypt to the delta in the N. The eastern desert,



Egypt. A view across the Nile delta, taken from the top of the Great Pyramid at Gizeh. It gives a good idea of the method of cultivation in the rich soil of the delta, and of the appearance of the countryside in Lower Egypt.

between the Nile and the Red Sea, called the Arabian desert, varies in width between 90 m. and 350 m. The Western, or Libyan, desert is part of the Sahara. The water of the oases in the Western desert—Siwa, Baharia, Farafra, Dakhla, Kharga—rises from a sandstone bed some 400 ft. below the surface.

The flora of Egypt is scanty, the country being barren of wood or forest. The most important tree is the date palm—some 30 varieties are grown. Other trees are the orange, clove, lemon, mulberry, and pomegranate, the sycamore, the tamarisk, and the milk tree. The vine occurs in the Farafra oasis. Egypt also grows limes, bananas, melons, prickly pears (Indian figs), and olives.

Of the animals, the most useful are the camel, ass, sheep, and buffalo. The horse is not much in evidence. Among wild animals, the chief are the hyena and gazelle, with, in the desert, the hare, fox, and jackal, and in the Nile valley the lynx, ibis, and bats. Reptiles include the horned viper, the echis, and the hooded snake. Lizards are numerous; so are spiders, beetles, fleas, mosquitoes, and scorpions; locusts are not common. Fish are plentiful; more than 300 species of birds occur.

Rainfall and Temperature

Egypt is virtually rainless. Even on the Mediterranean coast, the rainfall does not exceed 8 ins. a year. The mean temperature at Port Said and Alexandria is 57° F. in January, 81° F. in July. At Cairo it is 53° F. in January, 84° F. in July. The temperature is high by day and falls quickly at night. There is a prevailing north wind, utilised by craft sailing up the Nile. The Khamsin, which fills the air with sand from the Sahara, raises the temperature to as much as 115° F.

The chief towns are Cairo, the capital (pop., 1947, 2,090,654); Alexandria, the chief seaport (919,024); and Port Said (177,703). The coastline is more than 600 m. on the Mediterranean, and about 1,200 m. on the Red Sea. Part of it is rocky, but nowhere do the cliffs exceed a height of 1,000 ft.

PEOPLE AND LANGUAGE. The population has increased considerably since the beginning of the Turkish occupation, then probably less than 2,500,000. At a census in 1947 it was 19,021,840; (1954 est. 22,469,000). More than 90 p.c. are Muslims. The upper classes include dwindling Turkish, Albanian, Kurdish, and Georgian

elements. The most interesting type is the fellah; the most picturesque, the Beduin. The fellah is tall, thin, and wiry; he leads a life of extreme simplicity, wresting his livelihood from the soil; a *galabieh*, or blue cotton frock, and a turban comprise his wardrobe; his food is millet bread and raw vegetables. To the nomad Beduin, fellah is a term of contempt.

The Beduin—"people of the tent"—are shepherds and herdsmen, sturdy but somewhat undersized, with coarse, thick, black hair, and well-chiselled features. The Nubians, or Berberins, dwell in Upper Egypt, and are of mixed negro and Arab blood; the majority are peasants. The Copt is the native Christian of Egypt, and is usually a student or merchant; there are more than a million members of the Coptic Orthodox Church in Egypt, as well as members of other Oriental Christian churches.

Egyptian women have been described as models of beauty in body and limb between the ages of 14 and 20; few retain either good looks or fine physique beyond the age of 40. Many women of the upper classes have become Europeanised in both dress and habits. Egyptian girls marry early, generally between the ages of 10 and 16. Divorce, for the great Muslim majority, is in accordance with Mahomedan law.

Arabic is the universal language of Egypt. Turkish is rarely heard. Educated Egyptians usually speak French or English. After the fall of Bagdad, Cairo sprang into prominence as the chief literary centre of the Islamic world, and to the present day retains this distinction through its university of El-Azhar, at Cairo, the oldest university in the world, which attracts thousands of students from the whole Islamic world who devote themselves principally to Koranic learning.

EDUCATION. Primary education is compulsory between the ages of seven and 12; it was made free in 1944, as was secondary education in 1950. There are technical secondary schools and teachers' training colleges, for both men and women, and besides El-Azhar there are three general universities: the King Fuad in Cairo, founded 1908, taken over by the government in 1925; the King Farouk in Alexandria, founded by the government in 1943; and the Ibrahim I. A fourth university at Assiut was already planned in 1952. In the school year 1952-53 there were

1,464,446 primary pupils (524,997 of them girls), 180,750 secondary pupils (26,725 girls), and 32,736 university students (11,344 women).

CONSTITUTION. Egypt became a republic under President Mahommed Neguib in 1953 (*see* HISTORY *below*). Neguib was deprived of the presidency in 1954 and a council of ministers, headed by Gamal Abdel Nasser as prime minister, took over the government. In 1956 women were given the vote, and voting was made compulsory for men over 18 years old.

JUSTICE. Until 1949 international (or mixed) courts, set up in 1876 under capitulatory rights dating from the time of the Ottoman empire, tried all civil cases in which foreigners were involved, up to 1937 under laws based on those of France. A foreigner accused of a criminal offence went until 1937 before his own consular court. Egyptian national courts, set up 1883 to deal with cases involving only Egyptians, modelled their methods on the excellent practice of the mixed courts; but developing national sentiment made the existence of foreign courts a growing offence to Egyptians, and by a convention signed at Montreux May 9, 1937, the capitulatory powers agreed to abolish capitulations; and the former penal jurisdiction of the consular courts was transferred to the mixed courts, which were to come to an end in 12 years. New codes, applicable to both mixed and national courts, were promulgated, 1937; and on Oct. 14, 1949, mixed courts ceased to exist.

National Courts

The national courts comprise summary tribunals, under one judge, for lesser offences; central tribunals, with three judges each, for more serious offences; three courts of appeal, at Cairo, Assiut, and Alexandria; a court of cassation, above the appeal courts, set up 1931; and one function of a council of state established in 1946 was that of supreme court.

INDUSTRY. The Egyptian is an agriculturist. Ancient Egypt was the granary of the Roman world. With the coming of the Turks a different order of things was created, and a long period of depression and misery followed. The revival of Egyptian industry began with the elimination of the Turk by the British. Vast schemes of irrigation and drainage were developed until the cultivable area of Egypt proper was reckoned in

1918 at over 8,000,000 acres; at the time of the French occupation in 1798 the cultivable area totalled 3,520,000 acres.

Egypt, as the first sultan said, has three assets—the Nile, the Egyptian sun, and the fellah. Full use is made of both the sun and the Nile by the fellah. The sun shines all through the year, and the Nile is stored up so as to be available in any season. In addition, the fellah is extremely hard-working, and it is towards helping him in making the fullest use of the Nile that British brains and science were directed during 1899–1922. In the past the fellah had to wait upon the flood-tides. Nowadays, instead of obtaining water for his land for only a portion of the year, he obtains a regular and sufficient supply all the year round. The whole system is being directed towards perennial irrigation—thus assuring two and often three crops every year.

Basin System of Irrigation

Where perennial irrigation is impossible, the basin system has been adopted, whereby water is stored in Aug. and kept in reserve till Oct. when it begins to be used. The basin system is the oldest system of irrigation known to Egypt. Only one crop a year can be grown from it. Another system is used on the high lands near the Nile. These lands cannot be reached through canals, so the water is pumped up to them. The British introduced steam-pumps; but the water-wheel, worked by buffaloes, or the water-lift (*shadûf*), worked by hand and used in ancient Egypt (see illus. in p. 2960), is still in favour among the conservative fellahin. There are three agricultural seasons: cotton, sugar, rice, and, in a lesser degree, millet and vegetables, are grown in summer; wheat, barley, flax, and vegetables in winter; maize, millet, and flood rice between August and November.

Egypt's potentialities have not been by any means fully tapped. But production of petroleum (more than 2,350,000 metric tons in 1953) and of phosphate rock, for instance, and the growing of cotton and sugar cane are being steadily developed. Salt (273,056 metric tons exported in 1953) and asbestos, talc, building stone, carbonate and sulphate of sodium are other valuable products. Sea and lake fishing occupies some 66,000 men, with 11,700 boats. The country waxed fat during the Second Great War, supplying the needs of a large British army.

But cotton remains the basis of Egyptian prosperity; in 1953–54, 267,500 tons were exported. Apart from cotton, the chief crops were food grains (wheat, barley, maize, millet, rice), beans, lentils, and onions. Though trade totals fluctuate, imports exceed exports. The movement towards industrialisation began with the setting up of a small steel plant in 1949: it produced 20,000 tons in 1951 and 1952, rising to some 60,000 tons in 1953. Further development may be expected with development of hydro-electricity.

The lines of commercial communication to Egypt are, by virtue of the country's geographical position, of great importance. Besides being a distributing centre for the Levant, it holds a commanding position on the trade routes from Europe to the East. By the completion of the Suez Canal in 1869, a direct sea route was opened via the Mediterranean and the Red Sea. Considerable use is made of Alexandria and Port Said by foreign steamship companies. Passenger traffic is at its height in the winter when there is an influx of tourists. In 1950 there were more than 4,000 m. of state railways, and 862 m. of privately owned light rlys.; some 1,200 m. of macadamised, and 7,500 m. of non-macadamised, roads. The Misr airways runs services within the country and in the Near East, while Cairo is an international airport of outstanding importance.

MEDIEVAL AND MODERN HISTORY. When the Roman Empire was divided in A.D. 395, Egypt went to the eastern part. It was lost to the Byzantine Empire when it was overrun by the Arabs in A.D. 641, but only very gradually did Islam replace Christianity as the religion of the majority of the people. When in the 10th century the Arab empire broke up, Egypt enjoyed independence from 969 to 1171 under Fatimide caliphs. They were conquered by Saladin, whose descendants ruled Egypt until they were overthrown by the Ottoman Turks in 1517. The arrival of the Turks made little change in the administration of the country; indeed, their apathy led to a long period of unrest, which culminated in 1609 in a mutiny among the Turkish army of occupation. This was put down in 1610. Risings among the Egyptians and the Turkish soldiers, plague, and famine marked subsequent years. Pestilence in

the spring of 1619 is said to have carried off 635,000 persons, and similar scourges in 1643 wiped out 230 villages.

In the next century Ali Bey succeeded in introducing a measure of order and reform. He suppressed the outlawed Beduin in Lower Egypt, and in 1768 declared Egypt independent, taking the title of sultan. The Turks, however, defeated him in 1773, and re-established their suzerainty. Government then fell into the hands of the officers of the local garrison army, ex-slaves called Mamelukes, who ruled in the name of the sultan, but were virtually independent.

A new epoch opened with Napoleon's short-lived conquest of Egypt in 1798. Nelson's victory of Abukir Bay, later in the year, cut Napoleon off from reinforcements, and in 1799 he was back in France. Mehemet Ali, an Albanian, distinguished himself in the struggle with Napoleon, and in 1805 was made pasha of Egypt by the sultan. Six years later he massacred the Mamelukes, and established his authority as the sultan's representative. From him descended the royal family of 20th century Egypt, and on his grandson Ismail Pasha the sultan in 1867 bestowed the title khedive (prince).

International Control of Finance

Corruption and maladministration led to a state of financial chaos which came to a head in 1876 when the khedive suspended payment of his treasury bills. Egypt owed abroad £91,000,000, and the khedive invited France, Italy, Austria, and the U.K. to nominate members of a commission on the public debt. The U.K., hesitant at first, in the end appointed Sir Evelyn Baring (later Lord Cromer) to serve with the nominees of the other three countries. European direction improved Egypt's finances, but caused political difficulties.

In 1879 Nubar Pasha, minister of public works, and Sir C. Rivers Wilson, the minister of finance, were assaulted by a crowd of Egyptian officers. Ahmed Arabi, an Egyptian of humble origin who had risen to be a colonel, led a successful revolt of the army, and compelled the khedive to change his ministers. Disturbances in the country led to foreign intervention. Batteries raised by Arabi at Alexandria for use against the British fleet were bombarded by the British from the sea, and at Tel-el-Kebir a

British force under Sir Garnet Wolseley defeated Arabi's army, 1882, killing 2,000 Egyptians and taking the surrender of 15,000. But the British government still had no wish to do more than restore order and create stability, and did not leave forces in Egypt.

A new difficulty in the way of creating stability arose from a fanatical religious rebellion in the Sudan, led by Mahomed Ahmed, called the Mahdi (prophet) of the Sudan. In 1883 an Egyptian army of 10,000 commanded by General Hicks and sent to restore order in the more distant regions of the Sudan was annihilated by the Mahdi's men at El Obeid in Kordofan. The British government decided to abandon the Sudan and withdraw all the garrisons there. General Gordon, sent to report on the military situation and on ways of carrying out the intended evacuation, was besieged in Khartum by the Mahdi's troops, 1884-85. A relief expedition, reluctantly sent, arrived just too late to save him. Sir Herbert (Lord) Kitchener, appointed sirdar of the Egyptian army 1892, recaptured Khartum on Sept. 2, 1898, and in 1899 a treaty between Egypt and the U.K. established a condominium over the country, thenceforward, until 1952, called the Anglo-Egyptian Sudan (*q.v.*).

A New Era of Prosperity

The more settled state of the Sudan helped directly in improving conditions in Egypt. Harsh taxes were abolished; drainage and irrigation were improved; a contract for the construction of the Nile reservoirs was signed in 1898; post office savings banks were introduced in 1900; and navigation dues on the Nile were abolished. In 1907 when Lord Cromer's work as British agent in Egypt ended the country enjoyed prosperity unprecedented in its modern history.

In 1911 Kitchener became the British agent. He increased the water supply by building barrages and reservoirs; built roads; and pacified various religious and political factions. He established markets throughout the country to which the fellaheen could bring their raw cotton and get a fair price for it; while the Five Feddans Law prohibited the seizure for debt of the agricultural holdings of farmers who did not own more than five acres.

But relations between Kitchener and the Khedive Abbas II were strained, for Abbas was not amicably disposed towards the British,

and in Dec., 1914, Abbas was deposed. His uncle Hussein succeeded, with the title of sultan of Egypt, Great Britain declaring Turkish suzerainty at an end and proclaiming Egypt a British protectorate. Hussein died in 1917 and was succeeded by his youngest brother Ahmed Fuad. During the First Great War Egypt was on the whole prosperous and quiet.

Egypt Declared Independent

In 1919 a group of nationalists advocated a degree of autonomy that would leave the U.K. only the right of supervising the public debt and shipping facilities on the Suez Canal, but the British government refused to abandon responsibility for good order. Grave disturbances broke out in various parts of the country, and Lord Allenby was appointed special high commissioner for Egypt and the Sudan. A mission under the colonial secretary Viscount Milner was sent out, which began negotiations that lasted until 1922. In that year the British government declared Egypt an independent state except that the U.K. retained responsibility for the time being for the protection of imperial communications in Egypt; the defence of Egypt against all foreign aggression or interference; the protection of foreign interests in Egypt; and the protection of minorities and the Sudan. Ahmed Fuad Pasha was proclaimed king as Fuad I on March 16, 1922, and a constitution was promulgated in 1923. But in 1924 the Egyptian government demanded complete independence and union of the Sudan with Egypt; and when these demands were refused by the British, disorders broke out, and General Stack, governor-general of the Sudan and sirdar of the Egyptian army since 1919, was murdered in Cairo. The British ordered the withdrawal of all Egyptian officers and men from the Sudan, and reinforced British troops in Egypt. In 1926 the Wafd (Nationalist) party won easily at the elections; but neither the palace nor the British high commissioner (Lord Lloyd) wanted the Wafd in office, and minority leaders were invited to form what proved to be a series of short-lived governments. A new constitution was promulgated in 1930; it lasted for four years, and then in 1935 the constitution of 1923 was restored.

Fuad died in 1936, and was succeeded by his son Farouk (b. 1920). Partly because of internal difficulties, and partly as a result of

Italy's invasion of Abyssinia, all political parties formed a united front, and negotiations began for a new treaty with the U.K. These resulted in a 20-years' treaty, signed in London, Aug. 26, 1936, by which the U.K. agreed to end its military occupation of Egypt, to recommend Egypt for membership of the League of Nations, and to exchange ambassadors; the treaty gave the U.K. the right to station 10,000 soldiers with 400 men of the R.A.F. in the Suez Canal zone. Egyptians were to be readmitted to the Sudan.

The Second Great War

To this treaty the Egyptians were loyal when the Second Great War began. But national aspirations were rising; popular clamour renewed the demands for complete independence, and union of the Sudan with Egypt, or "unity of the Nile valley"; and in 1945 the Egyptian govt. formally requested the opening of negotiations for the revision of the 1936 treaty. British and Egyptian delegations met in Cairo on May 9, 1946.

Agreement over the transfer of British military establishments that had been maintained in Cairo and the Nile delta was rapidly reached; begun in July, 1946, the change-over was completed on March 28, 1947, after which remaining British forces in Egypt were concentrated in the Suez Canal zone.

The British recognized the sovereignty of the Egyptian crown over the Sudan during the condominium, but considered that the Sudanese when politically mature should have the right to choose, if they wished, full independence. The Egyptians demanded immediate union of the Sudan with Egypt; and on Jan. 29, 1947, the premier Nokrashy Pasha announced that he had broken off negotiations and was submitting the question to the U.N. security council, which, after discussing the dispute Aug. 5 Sept. 10, postponed further consideration of it.

In common with other members of the Arab League, Egypt refused to recognize the partition of Palestine voted by the U.N. general assembly in 1947, and joined in the invasion of that country at midnight of May 14-15, 1948, when the British mandate expired. Negotiations in Rhodes conducted by the U.N. Palestine mediator led to the signing of an Israeli-Egyptian armistice on Feb. 24, 1949, Egypt remaining in occupation of Gaza and the strip of

coast from there to the frontier, and also preventing any supplies from reaching Israel via the Suez Canal.

The Wafd in Office

The Wafd party, which had boycotted the 1945 elections, was returned in 1950 with a majority in the house of assembly of 225 out of 319, and Farouk now accepted a Wafd government. Discussions for the revision of the treaty of 1936, resumed in Sept., 1950, had produced no result by Aug., 1951, when mass demonstrations in Cairo demanded cancellation of the treaty. On Oct. 8 the Wafd prime minister, Nahas Pasha, tabled decrees abrogating both the 1936 treaty and the 1899 agreement on the Sudan. Five days later Egypt was invited by the U.K., the U.S.A., France, and Turkey to join, on equal terms, an Allied Middle East command. The invitation was rejected forthwith, and on Oct. 15 the decrees of Oct. 8 passed the assembly with the enthusiastic support of the opposition. Organized terrorism broke out in the Canal zone, and British troops took over control from the ineffectual Egyptian police in Ismailia and Port Said. Egyptian workers in the mass left British employment; Egyptian railway, canal, and other officials refused their cooperation. British reinforcements were flown in, and the Royal Navy kept the canal working. Mass violence in Cairo on Jan. 26, 1952, led to damage to property estimated at from £10,000,000 to £50,000,000 (British property alone at more than £5,000,000). At least 60 people were killed, including 12 British. The same day Farouk dismissed Nahas Pasha.

One premier succeeded another until on July 23, 1952, Mohammed Neguib, an unknown army officer, carried out a military coup. Farouk abdicated on July 26 in favour of his infant son, born Jan. 16, and with his family, including the infant king, left Egypt; and on June 13, 1953, Neguib proclaimed Egypt a republic with himself as president and prime minister. Another army officer, Lt.-Col. Gamal Abdel Nasser, seized the premiership in April, 1954, the presidency in Nov., 1954.

Under an agreement reached in July, 1954, the last British armed forces left the Canal zone on June 13, 1956; and a month later, without any preliminary discussions Nasser announced the nationalisation of the Suez Canal (*q.v.*).

Long-standing border clashes between Egyptian and Israeli patrols came to a head on Oct. 29, 1956, when the Israeli army in strength attacked Egyptian forces in the Sinai peninsula. Next day the British and French govts. sent a joint ultimatum to Egypt and Israel demanding an end of hostilities. Israel accepted but, Egypt rejecting the ultimatum, went on to capture Gaza, Nov. 1, and sweep the Egyptians from Sinai by Nov. 2. To separate the warring forces a joint Anglo-French air attack on Egyptian airfields started on Oct. 31, and parachute troops were landed in the Canal zone on Nov. 5. Fighting ended at midnight, Nov. 6-7, following the acceptance by Egypt and Israel of an unconditional cease-fire subject to the dispatch of a U.N. police force to keep the peace between Israelis and Arabs. International units began to arrive Nov. 15, and British and French troops were gradually withdrawn during Dec. But no solutions of the problems involved had been reached by mid-1957.

Irené Clephane

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Egypt. British P. and O. line steamship (7,912 tons), sunk, May 21, 1922, in a collision off the French coast with a loss of 86 lives. With over £1,000,000 of bullion aboard, she lay at a depth of 426 ft. Between June, 1932, and Aug., 1934, an Italian firm, the Sorima co., recovered the bulk of the bullion.

Egyptian Hall. London place of amusement, 1812-1904. Situated at 171, Piccadilly, W.1, it was built in 1812 by G. F. Robinson, for the natural history collections of William Bullock, F.S.A., dispersed in 1819. Here were exhibited the Living Skeleton (Claude Amboise Seurat), in 1825, and the Siamese Twins, in 1829. B. R. Haydon (*q.v.*), in 1846, complained that while in one week "Tom Thumb" (C. S. Stratton) attracted 12,000 people, his own picture exhibition drew 133½—the ½ being a little girl. Later the hall was a centre for such entertainments as those of Albert Smith, Artemus

Ward, and "Mrs. Brown." From 1873 until 1904 when he removed to St. George's Hall, Langham Place, J. N. Maskelyne made it "England's Home of Mystery." For many years the exhibitions of the Dudley Gallery Art Society were held here. The figures of Isis and Osiris at the entrance were by Gahagan.

Egyptology. The study of the civilization of ancient Egypt in all its aspects. The period covered begins with Man's arrival in the Nile valley and ends with the latest hieroglyphic inscriptions in the 4th century A.D. The subject thus overlaps with the study of Coptic, the form of the ancient Egyptian language which, written in Greek characters with the addition of five borrowed from demotic, became the vehicle of Christian writings from the 2nd century, and which has continued in use in the Coptic (Christian) Church in Egypt till today.

Despite one or two earlier attempts to decipher the hieroglyphs with the aid of Coptic, and a few travellers' records from the 18th century, scientific observation of ancient Egyptian remains began only with the archaeologists attached to Napoleon's mission to Egypt in 1798; and no great progress was made until Champollion announced his discovery of the principles of the decipherment of hieroglyphic writing in 1823. The first 30 years of the 19th century also saw the formation in European capitals of the nuclei of the great collections of Egyptian antiquities. But while linguistic study developed steadily and inscribed monuments came to be treated with respect, the archaeological significance of the thousands of smaller objects continually being brought to light up and down Egypt was barely perceived until Flinders Petrie made his first expedition to the country in 1880. Mainly through his efforts, in the next 20 years excavation in Egypt developed a high standard of method and care, archaeologist and linguist cooperating and checking each other's findings in revealing the ancient civilization.

Egyptology became an academic subject with the foundation of a professorship at Berlin in 1842. Fifty years later the first chair of Egyptology in England was created for Petrie in London. Chairs were also established in most European countries, at three or four universities in the U.S.A., and in Cairo, in addition to

posts of academic standing in museums possessing Egyptian collections. In 1939 excavations were being carried out under licence from the Egyptian government by museums or scientific societies from Great Britain, France, Germany, Belgium, Italy, Poland, and the U.S.A. Some of these had already resumed work in Egypt by 1947. This work, however, is gradually being taken over by Egypt's own department of antiquities which, originally staffed throughout its upper ranks by Europeans, now consists almost entirely of Egyptians.

In 150 years since Napoleon's expedition, a vast scientific literature has sprung up. It has already far outgrown the point at which individual students can keep up with every aspect of Egyptological studies, despite the aid of modern bibliographical methods; with the result that the word Egyptologist is now a catholic term which embraces scholars in various fields who are compelled to be specialists and confine themselves more or less to the archaeological, the aesthetic, or the linguistic side of the subject.

S. R. K. Glanville, F.B.A., F.S.A.

Ehrenbreitstein. A town of Germany. It stands on the right bank of the Rhine opposite Coblenz. Until 1919 it was a strong fortress, a rock nearly 400 ft. in height overlooking the Rhine and the Moselle being the centre of the system of fortifications. Originally a Roman *castellum*, it became the property of the Treves electors, and was fortified by Eugene of Savoy in 1734. It was besieged frequently by the French, and demolished by Napoleon in 1801. It fell to Prussia in 1815, was refortified, and after 1870 modernised. In 1919 under the Versailles treaty the fortress was destroyed. The pop. of some 3,500 were up to 1939 engaged in the wine trade and shipping.

Ehrenburg, ILYA GRIGORIEVICH (b. 1891). Russian writer. Educated in Russia, he began his literary career at 20, and during the First Great War acted as war correspondent. Returning to Russia during the revolution in 1917, he later lived mostly in France. In the Second Great War he was again a correspondent and broadcast regularly from Moscow. Influenced by Gorki, his novels and stories were remarkable for their vivid characterisation. The best known include *Out of Chaos*, *Trust D.E.*, *A Street*

in Moscow, *The Loves of Jeanne Ney*. In 1942 (for *The Fall of Paris*) and in 1948 (for *The Storm*) he received the Stalin prize for literature.

Ehrlich, GEORG (b. 1897). An Austrian etcher and sculptor. A Viennese, he was educated at the Vienna school of arts. Awarded a gold medal at the Paris art exhibition of 1937, he emigrated that year from Austria to live in London. His busts—among them a notable one of the actress Elisabeth Bergner—water-colours, drawings, and etchings were exhibited in many international galleries, at the Royal Academy from 1940 regularly. The Tate Gallery has his bronze head of a boy, and President F. D. Roosevelt owned a donkey in bronze by Ehrlich.

Ehrlich, PAUL (1854-1915). German physiologist, born of a Jewish family at Strehlen, Silesia, March 14, 1854.

Prolonged experimental researches brought him world-wide renown, and in 1908 he shared with Metchnikov the Nobel prize for physiology and medicine. In 1899 he became director of the Speyer Institute of experimental therapeutics at Frankfort, which he made famous by his laboratory work in connexion with cancer. The founder of chemotherapy, Ehrlich also laboured to discover a safe and effective cure for syphilis, being latterly assisted by a Japanese doctor, Hata. It was not until 606 experiments had been made that in 1910 real success was in sight; the compound then discovered being called 606 or salvarsan. Ehrlich also invented new bacteriological stains, was one of the founders of serum therapy, and did important work on diphtheria antitoxin. He died Aug. 20, 1915.

Eibar. Manufacturing town of Spain, in the prov. of Guipúzcoa. It is 39 m. by rly. W.S.W. of San Sebastian. It makes guns, swords, bicycles, and sewing machines, and is noted for its damascened arms and other metal ware. Pop. 12,140.

Eichendorff, JOSEPH, BARON VON (1788-1857). German poet and novelist. He was born at Lubowitz, March 10, 1788, near Ratibor, Silesia, a member of a noble Catholic family. He published his first romantic novel, *Ahnung und*

Gegenwart, in 1815; *Aus dem Leben eines Taugenichts*, 1826, is well known; but Eichendorff ranks above all as a poet, his simple nature lyrics having taken their place in German popular song. He served against France, 1813-15, during 1820-44 occupied various public appointments, and in his later years was distinguished as a Catholic publicist. He died at Neisse, Nov. 26, 1857. His *Collected Works* (6 vols.) appeared in 1864.

Eichhorn, JOHANN GOTTFRIED (1752-1827). German scholar. He was born at Dorrenzimmern, Oct. 16, 1752, and in 1775 was appointed professor of Oriental languages at Jena, and in 1788 at Göttingen, where he lectured for the rest of his life, dying June 27, 1827. He was the first scholar to suggest that the synoptic gospels have one common source, and was a pioneer of the rationalist criticism of the Bible.

Eichhorn, KARL FRIEDRICH (1781-1854). German jurist. Born at Jena, Nov. 20, 1781, son of the above J. G. Eichhorn, he studied at Göttingen and lectured on law at Frankfort-on-the-Oder, and obtained a professorship at Berlin. He fought against France in 1813, and after 1815 was professor at Göttingen and at Berlin. In his later years he held high positions in the public service. He died at Cologne, July 4, 1854. Eichhorn is perhaps the greatest authority on the laws and institutions of the Germans. Besides his great *Deutsche Staats- und Rechtsgeschichte* (1808-23) he wrote on private and ecclesiastical law, and helped to found a legal periodical.

Eichstätt. Ancient town of Bavaria, Germany. It stands on the Altmühl, 15 m. N.W. of Ingolstadt. Founded by S. Boniface in 740 and having urban rights since 908, it is chiefly famous for old buildings and episcopal associations, for its bishops were princes of the empire until their lands were secularised in 1802. The cathedral, which is dedicated to S. Willibald and contains the tomb of that saint, is largely Gothic, but its towers are Romanesque. Among the other churches the most notable is S. Walpurgis, dating from the 17th century, which holds the saint's tomb and is visited by pilgrims on S. Walpurgis' day (May 1). There is a palace where the bishops and later the dukes of Leuchtenberg lived; this is now used as a law court, while another palace is used as a library and



Paul Ehrlich,
German physiologist

museum. Above the town is the Wilibaldsburg, once also a residence of the bishops, but now a museum. From 1817 to 1855 Eichstätt was part of the duchy of Leuchtenberg; thereafter Bavarian. Pop. 8,160.

Eider. River of Schleswig-Holstein, Germany. It rises near Kiel, and flows N.W. and W. across the peninsula to Tönning, where it forms a bay. Its length is about 115 m. Before the opening of the Kiel Canal it was important for navigation. Vessels could go along it as far as Rendsburg, whence a canal took them to Kiel, thus uniting the Baltic and North Seas. This canal developed into the Kiel Canal.

Eider Duck (*Somateria*). Genus of wild duck. Including several species, it is famed for its soft

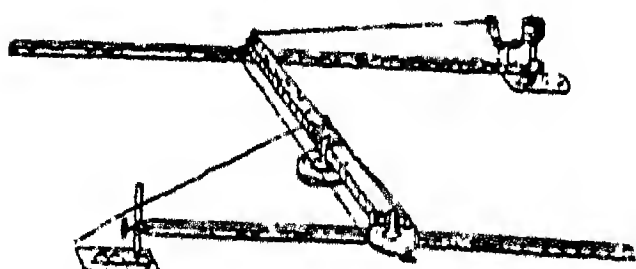


Eider Duck. Male, black and white; female, mottled brown

down, which it uses for lining its nest. Eiders have comparatively short beaks; the males have black and white plumage with green markings on the head, while the females have mottled brown plumage. The common eider (*S. mollissima*) is resident in Great Britain throughout the year, but breeds only on the Farne Islands. The king eider (*S. spectabilis*) and Steller's eider (*Polysticta stelleri*) are rare visitants.

All the eiders are divers, and feed upon shell-fish and small crustaceans. They keep to the rocky shores and nest on the ground. A pound of down can be obtained from about six nests.

Eidograph (Gr. *eidos*, form; *graphein*, to write). Instrument for copying drawings, designs, etc., reduced or enlarged, within limits, to any desired proportion. Somewhat on the lines of a pantograph.



Eidograph. Diagram of the instrument. The arms bearing tracer and pencil respectively move parallel in all directions, the connecting beam resting on a fulcrum

it comprises a slotted beam adapted to slide in a socket, having its axis in the centre line of the slot. Underneath each end of the beam is a wheel; the wheels are of the same diameter and geared together by a chain. Sliding in a guide in each wheel is an arm, one of which carries a tracer and the other a pencil, or the equivalent, for copying. The gearing together of the two wheels ensures that the arms will remain parallel for all positions of the instrument. The size of the copy is determined by the position of the beam in the socket.

Eifel. Plateau region of Germany, with small mt. ranges rising above it. Of low altitude (highest peak 2,500 ft.), they trend E. by S. between the Nette and the Ahr rivers towards the Rhine and the Moselle. The E. section is known as the Hohe Eifel, the W. section as Schnee Eifel, while the S. part, most pleasing scenically and most interesting geologically, is called Vorder Eifel. Near Cochem, on the steep wooded banks of the river Eltz, stood the castle of Eltz, a beautiful medieval building of wood and plaster, burnt in 1920. The area, left with only the *Volkssturm* to defend it, was conquered by the U.S. 1st and 3rd armies during the first week in March, 1945.

Eifelian. Name given to a stage of stratified rocks of Middle Devonian age. It consists of flagstones, shales, and beds of limestone attaining a thickness of 500 ft. in the Dinant district (Belgium). One series of shales (the Calceola shales) is named after a peculiar form of coral. It is well developed in Germany—in the Eifel district, whence the name, in the Rhine valley, the Hunsrück, the Taunus—and also in Bohemia.

Eiffel, ALEXANDRE GUSTAVE (1832-1923). French engineer. Born at Dijon, Dec. 15, 1832, he studied at the École Centrale, and executed his first notable work, the bridge over the Garonne at Bordeaux, in 1858. In 1865

he founded ironworks at Levallois-Perret, Seine. His outstanding engineering achievements include the bridge over the Douro at Oporto, 1876; the Garabit viaduct, Cantal, 1882; the great Eiffel Tower, Paris, 1887-89; the movable dome of the Nice Observatory; and the framework for Bartholdi's colossal statue of Liberty in New York harbour. He was one of the first engineers to use compressed-air caissons in bridge building, and invented movable section bridges. His investigations of air resistance were of service in the development of aeronautical engineering. He died in Paris, Dec. 28, 1923.



Eiffel Tower, Paris. It is 984 ft. high

Eiffel Tower. Building in Paris. It was designed and erected by Gustave Eiffel, for the Paris exhibition of 1889. It is 984 ft. high, and is built of iron throughout, 7,300 tons of that metal being used in its construction. The shape is that of a curved pyramid. Electric lifts take tourists to the top. The tower became an important wireless telegraphy station and meteorological centre.

Eigen Function. One of a set of solutions of a differential equation, e.g. Schrödinger's equation, such that any solution of this equation can be represented as a linear combination of members of this set. See Wave Mechanics.

Eiger. Mountain of Switzerland, in the Bernese Oberland (q.v.), adjoining the Mönch; alt. 13,042 ft. It was first ascended by Charles Barrington, 1858.

Eigg OR Egg. Island of the Hebrides, Inverness-shire, Scotland. It lies about 4 m. S.E. of Rum, facing the entrance to the Sound of Sleat, and is 6½ m. long and 4 m. broad. In the S.W. is the Scuir of Eigg, a porphyritic peak 1,289 ft. high. The rocks have been described by Hugh Miller, the Scottish geologist, in his Cruise of the Betsy. Pron. Egg.

Eight. In rowing, a name applied collectively to the members of a racing crew, when such consists of eight men, in addition to the cox. For the Oxford and Cambridge and other important boat races it became usual to have crews of eight, and so in course of time the word came to be used in this sense. See Rowing.



Gustave Eiffel, French engineer

Eight, PIECE OF. Name given to the old Spanish silver coin, the piastre; it was so called because it was divided into eight silver *reals*. It circulated in Spain and Spanish America during the 17th and 18th centuries, and was commonly met with through W. Europe. Its value was about four shillings.

Eighteenth Amendment, THE. Famous modification of the constitution of the U.S.A., enforcing

prohibition. This article of amendment became effective on Jan. 16, 1920, one year after its ratification. It prohibited the manufacture, sale, transport, import, or export of intoxicating liquors for drinking purposes, and was held to be largely responsible for the subsequent rapid growth of gangsterdom in the U.S.A., particularly in the eastern towns and cities. The amendment was repealed by the 21st amendment, 1933.

EIGHTH ARMY: FAMOUS BRITISH FORCE

Harry Gregson, formerly Editor of Eighth Army News

Few British armies captured the imagination of the public as did the 8th, especially in the days when it was fighting in the desert and advancing rapidly from Alamein (q.v.) to Tunis. See also North Africa Campaigns; Montgomery; Second Great War; Tobruk, etc.

The first British army to undertake large scale offensive operations against the Axis in the Second Great War was the 8th army; and its victory at Alamein against the combined German and Italian forces threatening Egypt was the first great success of British land troops, and a decisive battle of the world conflict. With the battle of Stalingrad, it marked the turning point in the fortunes of the Allies.

First Offensive

Formed in Nov., 1941, from a nucleus of troops experienced in desert warfare, the 8th army, under Lieut.-Gen. Sir Alan Cunningham (replaced a few days later by Maj.-Gen. Neil Methuen Ritchie), opened its first offensive against the Axis in Libya on Nov. 18. Tobruk, beleaguered by the enemy since April, was relieved; Benghazi fell on Christmas eve, Bardia and Halfaya were captured in Jan., 1942. Then in April came retreat before General Rommel, the disastrous battle of Knightsbridge (q.v.), the gallant but vain Free French defence of Bir Hakeim (q.v.), followed by the breakthrough of the German and Italian forces, the loss of Tobruk on June 22, of Mersa Matruh a week later, and the advance of the Axis forces to Alamein, some 60 miles only from Alexandria. The 8th army had lost 80,000 men, and been driven back 400 miles in less than two months, Rommel's rapid advance having been made possible by the use of captured British stores and vehicles.

At this critical juncture the c.-in-c., Middle East, General Sir Claude Auchinleck, took over tactical command of the 8th army, and succeeded in stabilising a front. At the beginning of Aug.

Winston Churchill, who said later, "I had some reason to believe that the condition of the desert army was not entirely satisfactory," visited Cairo, where "it was clear to me that the army must have a new start under new leaders." General Sir Harold Alexander became c.-in-c., Middle East, and Lieut.-Gen. B. L. Montgomery was appointed to command the 8th army.

Under its new commander, the 8th in the early days of Sept. held an armoured thrust, between Ruweisat and El Hemeimat, aimed at Cairo. Then on Oct. 23 came the attack at Alamein which initiated the victorious battle of Egypt, and the 8th army's 80-day advance in pursuit of a demoralised enemy across the N. African desert to Tripoli (occupied Jan. 13, 1943), 1,400 m. to the W. The 8th army entered Tunisia in the last days of Jan., overcame the Mareth Line (q.v.) in March, crossed the Wadi Akarit on April 6, and next day W. of Gabes made contact with American forces advancing from N. Tunisia.

Victory in Tunisia

At this point all the Allied forces in N. Africa came under the supreme command of Gen. Eisenhower, Alexander assuming fighting command of the British 1st army, the Americans, and the French troops in Tunisia as well as of the 8th. Tunis itself fell on May 7, the 11th Hussars (8th army) and the Derbyshire Yeomanry (1st army) being the first British units to enter the city. On May 16, Alexander sent a message to the prime minister, "Sir, It is my duty to report that the Tunisian campaign is over. All enemy resistance has ceased. We are masters of the N. African shore."

Preparations for the invasion of Sicily began immediately, and on July 10 the 8th army, now including the Canadian 1st division, made a landing in S.E. Sicily in conjunction with the U.S. 7th army. Sicily was conquered by Aug. 17, and on Sept. 3 British and Canadian troops of the 8th army landed on the Italian mainland, in Calabria. Fourteen days later they established contact at Agropoli with the hard-pressed 5th army, which had landed at Salerno. Other 8th army troops landed at Taranto had secured that port and Brindisi, and were advancing up the east coast of Italy.

Following the occupation of Naples (by the 5th army) on Oct. 1, while the 5th army continued to advance northward to the west of the Appennines, the 8th army advanced to the east of them until in May, 1944, the bulk of it was transferred westward to take part in the final battle of Cassino (q.v.) and the capture of the Gustav Line. It continued to fight through the mountainous backbone of Italy and up the east coast, occupying Florence and breaking the Gothic Line in Aug., capturing Rimini in Sept., Ravenna in Dec. In April, 1945, it helped to take Bologna, and, crossing the R. Po in an encircling movement, trapped the main body of the German army S. of that river. It entered Trieste on May 2 and received the surrender of the German commander; crossed into Austria on May 7. It was disbanded July 20, 1945.

Commanders of the Eighth

When Montgomery left Italy in Jan., 1944, to prepare for the invasion of N. France, Lieut.-Gen. Sir Oliver Leese took over command of the 8th army. Transferred to S.E. Asia in Nov., 1944, he was succeeded in the command of the 8th by Lieut.-Gen. Sir Richard L. McCree. Few armies in British history have captured the imagination of the world as did the 8th. Under Montgomery's inspiring command, it achieved successes scarcely equalled on any other front. By moving among the men, Montgomery made himself personally known to them; before major battles he explained to them the principal objects of his strategy—unusual characteristics in a general which helped materially in creating the sense of unity that was the 8th army's strength.

During the fighting in N. Africa the 8th army was composed in the main of British and Empire formations. These included at

different times the 7th armoured division (called Desert Rats from their divisional flash, a jerboa), the 51st (Highland) division, the 50th (Northumbrian) division, the 44th (Home Counties) division, the New Zealand 2nd division, the 4th Indian division, the Australian 9th and the S. African 1st divisions. Canadian, Polish, Italian, Greek, and Brazilian units served with it in Italy.

Eights Week. Popular name at Oxford for a period which includes a series of bumping races for college boats—the Oxford Summer Eights. The week begins on a Thurs. in May and ends the following Wed. Usually several crews are entered by each college and the races are rowed in divisions throughout each afternoon except Sunday. Eights Week is a social occasion in the university; with it are associated concerts and entertainments apart from the picturesque scene on the river.

Eighty Club. British political club. It was founded in 1880 to celebrate the victory gained by the Liberals at the general election of that year, its main object being to unite the younger members of the Liberal party and to encourage them in active political work. A president, usually a leader of the Liberal party, is elected annually. Women members were admitted in 1920. The club's headquarters are at 36, Victoria St., London, S.W.1.

Eijkman, CHRISTIAAN (1858–1930). Dutch pathologist. Born Aug. 11, 1858, at Nijkerk, Gelderland, he became an army surgeon. He took part in 1886 in a scientific expedition to the East Indies for an investigation of the beri-beri disease, and was made director of the pathological laboratory at Batavia, where he stayed until 1896. Here, by the experiment of feeding one hen on polished rice, another on unpolished, he established that beri-beri was due to a deficiency of some substance (later identified and named vitamin B1) which is present in the husk of rice grains. With F. Gowland Hopkins (*q.v.*) he was awarded the 1929 Nobel prize for physiology and medicine. As professor of hygiene at Utrecht from 1898 to 1928 he devised a process for detecting the bacillus coli in water. He died Nov. 5, 1930.

Eikon (Gr., image). Holy image or sacred picture used in the worship of the Greek Church, more usually spelled Ikon or Icon (*q.v.*).

Eikon Basilike (Gr., royal likeness). Book purporting to be written by Charles I, and published

immediately after his execution, although most of the early editions bear the date 1648. Its sub-title is *The Pourtraicture of His Sacred Majestie in His Solitudes and Sufferings*. It professes to give the king's views of the events of his reign, and a number of his prayers. Milton, in *Eikonoklastēs*; replied in detail to the work and first hinted at doubts as to its authorship. Historians take sides for Charles or for John Gauden, later bishop of Worcester, who claimed to have written it. There are editions by C. M. Phillimore, 1879; and E. Almack, 1904; consult also *Bibliography of the King's Book*, E. Almack, 1896.

Eil. Sea-loch between Argyllshire and Inverness-shire, Scotland. Forming a W. extension of Loch Linnhe, it is 8 m. long and has a mean breadth of $\frac{1}{2}$ m.

Eildon Hills. Range of hills in Roxburghshire, Scotland. Situated S. of Melrose, they rise into three peaks, the highest of which is 1,385 ft. On the slopes are a supposed Druidical tumulus and remnants of a Roman encampment. According to popular tradition, the single hill was split into three by the "wondrous wizard," Michael Scott of Balwearie.

Eilat. Fishing village and holiday resort of Israel, on the Gulf of Akaba, close to the Jordanian port of Akaba. It lies in a beautiful bay with great possibilities for development as a port. Near by are copper mines and a granite quarry. Pop. (est.) 2,000.

Eileithyaspolis. For this city of ancient Egypt, see under *El Kab*.

Eilenburg. Town of the German province of Saxony. It stands on the left bank and an island of the Mulde, 15 m. N.E. of Leipzig, and is a rly. junction. It is a centre of the textile industry, and also manufactures chemicals, pianos, furniture, and agricultural machinery. The castle, after which it is named, dates from the 10th century, but the town, known earlier as Ilburg, is older. It was part of Meissen and then of Saxony, in which it remained until given to Prussia in 1815. Pop. (pre-war) 19,500.

Einaudi, LUIGI (b. 1874). President of Italy. Born in Piedmont, March 24, 1874, he became professor of science and finance in Turin university, and was for many years economic editor of the *Corriere della Sera* and editor of *Riforma Sociale*, 1900–35, achieving a reputation as an economist far beyond his own country. He became a Liberal member of the

senate in 1919. Opposing the war against Abyssinia in 1935, he was exiled by the fascists, whose economic theories he had also criticised. Returning from Switzerland in 1944, he became governor of the bank of Italy, and a member of the constituent assembly, and in 1947 vice-premier and minister of finance. Elected 2nd president of the Italian republic 1948, Einaudi held that office until 1955.

Eindhoven. Town of the Netherlands, in North Brabant. It lies 8 m. W.S.W. of Helmond and is a rly. and an important road junction. In 1951 it was the sixth town of the Netherlands, pop. 144,000. A centre of the electric bulb industry, it has also radio, textile, and tobacco manufactures.

In the Second Great War it was frequently attacked by Allied bombers: the radio factory there, the largest of its kind in Europe, was an important source of supply for the German army. The British 2nd army reached Eindhoven, first Dutch town freed, Sept. 18, 1944. See also *Arnhem. Battle of*.

Einhard, OR EGINHARD (c. 770–840). Frankish historian. Born in East Franconia, he was educated at the monastery of Fulda and at the court of Charlemagne, where he was a pupil of Alcuin. He was made secretary and superintendent of public buildings by Charlemagne and was responsible for the royal palaces at Ingelheim and Aix-la-Chapelle. He continued to enjoy favour under Louis, Charlemagne's successor, who entrusted him with the education of his son Lothair, and in 815 bestowed on him the domains of Michelstadt and Mühlheim. In 827, unable to compose the quarrels between the emperor Louis and his sons, Einhard retired from court to Mühlheim, where he founded a monastery, and died March 14, 840. His wife was Emma, sister of the bishop of Worms, and not a daughter of Charlemagne, as later legends represent. His chief works are his *Epistolae*, and his *Life of Charlemagne*, one of the best biographies of the Middle Ages, and the source of most of our information about the great emperor (Eng. trans. A. G. Grant, 1905; H. W. Garrod, 1915). His authorship of the *Annales Regum Francorum* is disputed.

Einsiedeln. Town of Switzerland, in the canton of Schwyz. It stands on the Alpbach, 2,908 ft. above the sea, 25 m. by rly. S.E. of Zürich. One of the most famous pilgrim resorts of the world, it owes its importance to the great

Benedictine monastery, containing a miraculous black wooden image of the Virgin. The abbey, founded in 934, and rebuilt in the 18th century, was sacked by the French in 1798, but the treasury and library, with 50,000 valuable MSS., still contain many precious objects, portraits, etc. Thronged in the Middle Ages, Einsiedeln still attracts thousands of pilgrims annually. Zwingli was a parish priest here.

Einstein, ALBERT (1879-1955). German-born American physicist and mathematician, the most famous scientist of his age and one of the greatest thinkers of all time. Born March 14, 1879, of Jewish parentage, at Ulm in Württemberg, he was educated at the Luitpold high school in Munich. After a short residence in Italy, where he acquired a life-long love of music, his family moved to Switzerland; and at 16 he went to the Federal Polytechnic School at Zürich.

Failing to obtain a university teaching post, he held a junior position in the patent office at Berne, 1902-08. While there he produced technical papers in physics and mathematics of such brilliance as to establish his name amongst his scientific contemporaries. Appointed to a university post in the Technical University at Zürich, 1909, to the chair of physics at Prague, 1911, and to the professorship of theoretical physics at Zürich, 1912, he accepted in 1913 the directorship of the Kaiser Wilhelm Physical Institute, a post which carried with it a professorship in the University of Berlin.

For the next 20 years Einstein persevered in developing his generalised theory of relativity. He was elected a foreign member of the Royal Society, 1921, gained the Nobel prize for physics, 1921, and was awarded the Copley medal of the Royal Society, 1925. Away from his native Germany when the Nazis assumed power, he refused to return to a land which persecuted his coreligionists. Stripped of his property, he lived for some months in seclusion in Belgium, emerging only to take part in mass protest meetings against Nazi persecution. In 1933 he joined the institute of advanced studies in Princeton, New Jersey, as professor of theoretical physics, retiring in 1945. He had been a pacifist during the First Great War, but in 1939 he wrote to President Roosevelt warning him that the extraction of energy from nuclear fission, lately demonstrated with single particles, might be turned to account by

Germany in making a military weapon of devastating power. This letter played a substantial part in the political decision of the Allies to develop the atomic bomb.

He became a U.S. citizen in 1940. After the war he continued his Zionist work, and in 1952 he received, but declined, an invitation to become president of Israel. He died at Princeton April 18, 1955.

Einstein's scientific work has been compared with that of Isaac Newton. Whilst Newton's achievements were doubtless the more fundamental in that his theories brought predictable order out of observational chaos, Einstein's will probably have the more far-reaching immediate effects in the practical field. As a young man he was impressed by the discrepancies between classical radiation theory and the Planck hypothesis that light appears only in terms of discrete energy quanta. His first scientific papers, 1901-05, on statistical thermodynamics led to his mathematical demonstration in 1905 that light was propagated in whole quanta, and could bombard matter in the form of individual photons. This explained the observed facts of photo-electricity and led to the rational explanation of optical spectra given by Bohr in 1913. But the part of Einstein's work in this period that attracted most attention was the development of the restricted theory of relativity. This was contained in a paper, 1905, "On the Electrodynamics of Moving Bodies," which announced, as a new basic principle of physics, that time and space are not absolute concepts, and that each observer uses units of space and time that are so adjusted as to make it impossible to detect, even by experiments with light, any common uniform motion. In 1906 Einstein drew the further conclusion from this theory that with each unit of mass m is associated an amount of energy $E=mc^2$, where c is the velocity of light. In this equation lies the key, on the cosmic scale, to the source of stellar energy and, on the terrestrial scale, to abundant nuclear power.

Another decade passed before Einstein was able to generalise his theory to make it applicable to accelerated motion and to the phe-



Albert Einstein,
American physicist

nomenon of gravitation. Though the philosophical differences between the general theory of relativity, 1916, and Newtonian mechanics are enormous, the practical differences are minute, and lie entirely in the realm of astronomy. One concerns a slow rotation of the orbit of the planet Mercury, the magnitude of which was accurately explained by general relativity. A second difference lies in the behaviour of a ray of light in a gravitational field. Einstein's theory predicted a bending which is just sufficient, for light grazing the Sun's surface, to be observed during a total solar eclipse. British expeditions—one from Greenwich to Sobral, N. Brazil, the other from Cambridge to Principe off the W. coast of Africa—triumphantly verified the effect at the total eclipse of May 29, 1919.

His third prediction, that spectrum lines should be displaced towards the red in a strong gravitational field, is more difficult to observe. Nevertheless, Einstein was encouraged to develop the cosmological implications of his theory and (in collaboration with de Sitter) he devised, 1932, a mathematical model of an expanding universe that bears a close resemblance to the real universe as revealed by the giant telescopes developed in mid-20th century.

Thereafter he concentrated on generalising the basic concepts of physics into a unified field theory, representing all physical forces—electro-magnetic, nuclear, and gravitational—together with matter and radiation, into one unified whole. Two years after his death it was still too early to assess whether his latest attempt, 1951, at this was aimed aright.

Einstein wrote in German and his works are extremely technical. The most popular of them was published in an English translation in 1922 as *The Meaning of Relativity*; a final revised edition appeared posthumously in 1956. His other works include *My Philosophy*, 1934; *The World as I See It*, 1935; *The Evolution of Physics* (with L. Infeld), 1938. Consult *Einstein the Searcher*, A. Moszkowski, 1921; *Lives*, A. Reiser, 1931; *D. Reichinstein*, 1934; *H. G. Gomborian*, 1939. *Albert Einstein, Philosopher Scientist*, ed. P. A. Schilpp, 1951.

Einthoven, WILLEM (1860-1927). Dutch physiologist. He was born May 21, 1860, at Samarang, Java, and educated at Utrecht. Professor of medicine and physiology at Leyden from

1886 until his death, Sept. 28, 1927, he specialised in devising methods for exploiting electricity in the diagnosis of disease. In 1911 he invented a string-galvanometer, the basis for the electro-cardiograph. In 1924 he was awarded the Nobel prize for physiology and medicine in recognition of the great progress made through his inventions in the treatment of heart diseases.

Eire. Irish name of Ireland, commonly used during 1937-49 for that part of the island constituting the Irish Republic (formerly the Irish Free State) as distinct from Northern Ireland. See Ireland; Irish Republic; Northern Ireland.

Eisenach. Town of E. Germany. It stands in the valley of the Hörsel, 32 m. by rly. W. of Erfurt, and was internationally known mainly by the neighbouring Wartburg (*q.v.*) with its legends and history. Of its seven monasteries in the Middle Ages, one is partly preserved, together with the Romanesque church of S. Nicholas (12th century) and the church of S. Anne (13th century). The market church, former palace, built 1742-45, and town hall, built 1508, rebuilt 1638, are other remarkable buildings which survived the Second Great War.

J. S. Bach was born and Luther went to school in Eisenach, which was renowned for its schools, theatre, museums, and spa for rheumatic diseases. Founded in the 12th century by the Thuringian landgraves, it was a capital of a separate duchy from 1672 to 1741, then united with Weimar. It remained the second residence of the dukes of Saxe-Weimar-Eisenach until 1918. It fell to American infantry in the Second Great War, April 6, 1945. Pop. (est.) 45,000.

Eisenberg. Town of E. Germany, in the sub-district of Altenburg. It is 24 m. W. of the town of Altenburg, and is connected by rly. with Leipzig. Old buildings included a castle, churches, schools, etc., and there are porcelain and piano factories. Pop. (est.) 12,000.

Eisenhower, Mount. Peak of the Canadian Rockies. Formerly called Castle Mt., it was renamed in 1946 in honour of Dwight D. Eisenhower for his successful work as supreme commander of the Allied expeditionary forces in north-west Europe during 1944-45. The mountain is near Banff, in the S.W. of Alberta. Its altitude is 9,390 ft.

D. D. EISENHOWER, 34th U.S. PRESIDENT

Lieut.-Gen. Sir Gifford Le Quesne Martel, K.C.B., D.S.O.

Eisenhower, whose ability to secure the loyalty and co-operation of the men of varied nationality and personality who served under him during the Second Great War was a vital factor in the success of his campaigns, in 1953 achieved the highest position his country could give him—that of President of the U.S.A.

Dwight David Eisenhower was born on Oct. 14, 1890, at Denison, Texas, U.S.A., the 3rd son of David J. Eisenhower and Ida Elizabeth Stover. His family moved shortly afterwards to Abilene, Kansas, where he received his early education. In 1912 he went to the U.S. military academy at West Point, graduating 1915. He did not take a leading position in his academic studies at school or at the academy, though he passed his tests satisfactorily; at both he excelled in sport and games.

During 1915-1917 he served in the infantry as a company officer, and as an instructor in army service schools at Fort Leavenworth. In 1918 he organized and commanded Camp Colt, a training centre for tank corps troops. He remained with the tank corps until 1922; then became executive officer of Camp Gaillard, Panama, and subsequently served in various posts in many parts of the U.S.A. In 1926 he graduated at the command and general staff school, Fort Leavenworth, Kansas, being placed first in the list. Next year, with the rank of major, he was appointed to the American battle monuments commission in Paris.

During 1929-33 he was assistant executive in the office of the assistant secretary of war, graduating meanwhile from the army industrial college, and drafting the war department's plans for indus-

trial mobilisation in case of war. Until 1935 he served in the office of the chief of staff; then until 1940 he became assistant military adviser (under Gen. MacArthur, *q.v.*) to the commonwealth of the Philippines. On returning to the U.S.A. Eisenhower served, in quick succession, as chief of staff to the 3rd division, the 9th corps, and the 3rd army, taking in the last named post a prominent part in the 1941 manoeuvres in Louisiana—largest peace-time military exercise ever held in the U.S.A. By now a brig.-gen., he went to Washington as assistant chief of staff in charge of the operations division, war department general staff, under Gen. Marshall (*q.v.*), until in June, 1942, now a maj.-gen., he was ordered to England, as commander of U.S. forces in the European theatre of operations (a new post), with instructions to begin preparations for U.S. participation in a cross-Channel attack against "Fortress Europe." His promotion to lieut.-gen. followed.

Shortly after his arrival in England, he was ordered to take command of the Allied attack on Vichy-controlled French N. Africa. The Vichy and U.S. governments were still in diplomatic relations; and since information furnished by the American chargé d'affaires in Algiers, Robert Murphy, led the Allied leaders to believe that whereas a British landing force might encounter opposition the Americans would be welcomed, it was decided that the initial landings should be made by U.S. forces only, a British force landing later, with General Eisenhower as c.-in-c. of the whole.

Eisenhower made his own attitude towards his command clear by stating: "This is an Allied campaign . . . There will be neither praise nor blame for the British as British or the Americans as Americans. We are in this together as allies. We will fight it shoulder to shoulder."

The date set for the invasion was Nov. 8, 1942. The day before, Eisenhower broadcast two messages, also distributed by air, to Frenchmen in N. Africa, emphasising that his forces came as friends to make war against France's enemies, and that the



Dwight D. Eisenhower

sovereignty of France over French territory remained unaffected. Giraud (*q.v.*), describing himself as c.-in-c. of French forces in N. Africa, broadcast an appeal for support from his fellow countrymen; while De Gaulle (*q.v.*) broadcast from London, urging the French in N. Africa to rise and help France's allies. Satisfactory landings—the largest operation of the kind ever attempted to that date—were effected in Algeria, though not without serious opposition, brought to an end on Nov. 11 when Admiral Darlan (*q.v.*), c.-in-c. French (Vichy) Forces, who happened to be in N. Africa, decided to throw in his lot with the Allies and ordered the French to cease fire.

Appointed C.-in-C. North Africa

While the Allied troops under their field commanders advanced against increasing German opposition into Tunisia, Eisenhower found himself involved in a net of French political intrigue in Algiers, somewhat simplified by the assassination of Darlan, whom no one trusted, on Dec. 24, 1942. President Roosevelt and Winston Churchill, meeting in Casablanca in Jan., 1943, eased the political situation by bringing De Gaulle and Giraud into personal contact there; and in consultation with the combined chiefs of staff settled the order of military precedence to include the 8th army, then advancing towards Tunisia. This decision, made public on Feb. 6, created a N. Africa operational theatre under the command of Eisenhower, with Gen. Alexander as his deputy. Eisenhower's promotion to gen. followed in a few days. Churchill, who spent Feb. 5 and 6 with him at Algiers, told the house of commons on Feb. 11, "I regard him as one of the finest men I have ever met."

The course of the fighting in Tunisia is described under North Africa Campaigns. It finished in May, and preparations were immediately begun for a landing in Sicily (*q.v.*), conquest of which was carried through triumphantly under Eisenhower's command between July 10 and Aug. 17, 1943. The swiftness of this operation led to the downfall of Mussolini, and the surrender of Italy on Sept. 3, the day of the first Allied landings (again under Eisenhower's command) on the mainland of Europe near Reggio in Catania.

In Dec. Eisenhower was notified by the combined chiefs of staff that he had been appointed supreme commander of the British

and U.S. expeditionary forces organizing in the U.K. for the liberation of Europe. In a press interview at his G.H.Q. in N. Africa, he declared that his immediate job would be "to weld the directing team together in such a way that no real friction ever develops, that people trust each other, work in unison, and go into this thing with their full weight."

Eisenhower had proved not only his own ability to work with men of other nationalities and of varying temperaments, but also a rare capacity for getting them to work together, and he was to continue to demonstrate these gifts essential to the successful outcome of the Allied purpose.

The outline plan of Overlord, as the operation in which he was now engaged was called, had been approved at the Quebec conference in Aug., but when Eisenhower studied it early in Dec. he felt the initial assaulting forces proposed were of insufficient strength, and the front too narrow.

On his arrival in London on Jan. 15, 1944, he initiated discussions which led to an increase in the striking force from three to five divisions, and the extension of the beach-head area. His official appointment as Supreme Commander Allied Expeditionary Force dated from Feb. 14. His headquarters (known as SHAEF), located at first at Norfolk House, St. James's Sq., London, was moved at his desire, with the object of closer unification, to Bushey Park, near Kingston-on-Thames, in March.

His Irrevocable Decision

The date originally set for the invasion was May 1; but the insufficiency of assault craft for the larger striking force Eisenhower was using made postponement necessary, and the first week of June was chosen instead, Eisenhower setting June 5 as the first date, subject to last minute revision if the weather were unfavourable. The 6th and 7th were equally acceptable, but then the next date on which conditions of time and tide were suitable was June 19. June, 1944, brought the roughest weather experienced in the Channel in June for 20 years. The weather forecast on the morning of June 5 "contained a gleam of hope," says Eisenhower, for the following day. "At 04.00 hours on June 5 I took the final and irrevocable decision: the invasion of France would take place on the following day." The great-

est decision in military history had been made, and the victorious campaign (described under the heading Europe, Liberation of) was initiated.

After the departure of the German delegates from the surrender ceremony at Reims on May 7, 1945, Eisenhower said to the Allied commanders who had witnessed it: "This unconditional surrender has been achieved by team work. To every subordinate in this command of five million men who took part I owe a debt of gratitude which I can never repay." In the conclusion of his report on the operations in N.W. Europe he wrote: "The United States of America and Great Britain have worked, not merely as allies, but as one nation, pooling their resources of men and material alike. . . . An allied experiment unprecedented in the history of the world has been carried out with decisive results." The overwhelming success of this gigantic experiment was the measure of Eisenhower's greatness of character and his wisdom.

Awards and Honours

Eisenhower was among the first three soldiers to be made general of the U.S. army when that five star rank was created Dec., 1944. He was chosen in March, 1945, to be c.-in-c. of the American forces of occupation in Germany, and chief U.S. representative in the Allied military government of Germany, posts he assumed after the surrender of the German forces in May, making his H.Q. at Frankfurt-on-Main. On June 11 he flew to England. Next day he drove through cheering crowds to the Guildhall to receive the freedom of the city of London, and the sword worn by Wellington at Waterloo, pending completion of a special sword of honour. The same day King George VI conferred on him, its first American recipient, the O.M. (he had been made hon. G.C.B. in 1943). On June 18 he was in Washington, where he addressed a joint session of Congress, describing the work of a commander as "a soul-killing task," and expressing his deep sense that war must not happen again. President Truman conferred on him the D.S.M. On an official visit to New York next day, to receive its freedom, he was given the biggest reception in the city's history, the crowd along his 37-mile drive being estimated at four million. The Order of Victory, highest Russian decoration, was conferred on him in June, and

when he visited Moscow in Aug. he was fêted by Stalin. Then he went to Belfast and Edinburgh, receiving the freedom of both, and the life gift of a flat in Culzean Castle, Ayrshire. On Nov. 20 Eisenhower, who favoured a unified command for the U.S. armed forces, was made U.S. chief of staff.

Appointed president of Columbia university, New York, in 1947, Eisenhower was supreme Allied commander in Europe in the North Atlantic treaty organization, 1951-52. He had in 1948 refused suggestions from both Republicans and Democrats that he should be candidate for the presidency; but in 1952 he gave up his appointment in Europe, resigned from the army, and accepted nomination as Republican candidate. In the election he carried 39 of the 48 states, to become the first Republican elected president for twenty years; and in Jan., 1953, was sworn in as 34th president of the U.S.A. He himself again carried the country triumphantly in 1956; but the Democrats carried a majority in both houses of congress.

Eisenstadt. Town of Austria, in the prov. of Burgenland. It is 25 m. S.E. of Vienna, at the base of the Leitha Mts. It is famous for its magnificent palace, long the residence of the Esterhazy family. Built in 1683, and enlarged in 1805, this has a fine library and beautiful gardens. The town has also a Franciscan monastery, with a church in which members of the family of Esterhazy are buried. Haydn, conductor of the palace orchestra from 1760 to 1790 is also buried there.

Eisenstein, SERGEI (1898-1948). Russian stage and film producer. Born in Riga he became a scenic artist in 1920. His interest in psychology was evidenced in his methods of dramatic production; and when in 1924 he directed *The Strike*, the first film in which masses of people took the place of single characters, he was recognized as a force in film technique. His later films, largely propagandist, included *The Battleship Potemkin*, *Ten Days that Shook the World*, *The General Line*, *Thunder Over Mexico*; and the historical dramas, *Alexander Nevsky* and *Ivan the Terrible*. Producer for the first Russian workers' theatre, he was awarded the Order of Lenin, 1939, and the Stalin prize, 1941. He wrote *The Film Sense* 1943, and articles on films and film technique in periodicals. He died at Moscow, Feb. 10 1948.

Eisleben. Town of Germany, in Saxony. It is 20 miles W.N.W. of Halle, and is famous for its association with Luther, who was born and died here. The chief churches are those of S. Andrew and SS. Peter and Paul, both 15th century. There are separate town halls for the upper and lower towns. The memorials of Luther include the house in which he died, now a museum, a school which he founded, and a bronze statue. Eisleben has a school of mining, and is the trading centre for silver and copper mines. It was long on the lands of the counts of Mansfeld. In 1710 it passed to Saxony, and in 1815 became part of Prussia. It was in the Russian occupied zone of Germany after the Second Great War. Pop. approx. 25,000.

Eisner, KURT (1867-1919). The name adopted by Salomon Kosnowsky, German Socialist writer and politician. He was born in Berlin, May 14, 1867, of Galician-Jewish origin. Joining the Socialists he became associate editor of their organ, *Vorwärts*. When the First Great War broke out he joined his party in supporting it, but before the end he was one of the South German leaders who opposed the Kaiser. On the outbreak of the revolution of Nov., 1918, he himself took the position of prime minister and minister of foreign affairs, and later that of first president of the Bavarian republic. He sought to separate Bavaria from the rest of Germany, and to make separate peace arrangements with the Allies, but unavailingly, and was assassinated in Munich, Feb. 21, 1919.

Eistaler Spitze. A peak in Czecho-Slovakia, 8,630 ft. It is one of the most difficult climbs in the High Tatra, but the views from the summit over the wide plain of Galicia to the N., and the Hungarian lowlands to the S., well repay the climber.

Eisteddfod (Welsh, session). Welsh national bardic festival: a public meeting at which contests are held in music, making or reciting poetry, writing prose, and arts and crafts of all kinds. Hardly a district in Wales does not hold a local Eisteddfod at least once a year; and the National Eisteddfod is held in N. and S. Wales alternately during the first week in Aug. The date of origin is not known, but certainly the holding of contests is an ancient custom among the Welsh. A festival held by Lord Rhys in Cardigan Castle in 1176 was "proclaimed" a year in advance in Wales, Ireland, Scotland, and England. There were two main contests, one for poets and one for musicians, and the winner in each contest was given a chair.

The next Eisteddfodau of which there are records were at Carmarthen (1450), and Caerwys (1523 and 1568). Probably many minor festivals were held in Wales during the 17th and 18th centuries, but they bore little resemblance to the modern Eisteddfod. In 1789 there were great assemblies at Llangollen and Corwen. Soon afterwards societies sprang up throughout Wales to foster literature and music and the Welsh language. In 1819 at Carmarthen the Gorsedd, with its colourful bardic rites, came for the first time



Eisteddfod. Ceremony of the Gorsedd, as held in 1939 at Bridgend, Glamorganshire; the sword of peace is being raised aloft

into the framework of the Eisteddfod. Contrary to popular belief, the bardic ceremony is not a legacy from the pre-Christian era, but an invention of Edward Williams (Iolo Morgannwg) in 1792. He meant the Gorsedd to take the place of the Eisteddfod, which however gained ground so quickly that he decided to make the former part of the latter. At Carmarthen, taking some pebbles out of his pocket and laying them in a circle on the ground, he started the tradition by which the great circle of stones is seen when the Gorsedd is held in the open air.

At the Denbigh Eisteddfod of 1860, a council was set up to organize a single annual festival for the nation. The council was replaced in 1880 by the National Eisteddfod Association, which became the National Eisteddfod Council in 1937. One of its functions is the publication of prize-winning works and adjudications. During the Second Great War the Eisteddfod was held in a curtailed form.

Ejectment (Lat. *ejectare*, to cast out). Name of an old English action to recover possession of land. Originally it could be brought only by a leaseholder and not by a freeholder; but by the fiction of John Doe (*q.v.*) judges allowed it to be made use of by freeholders, who preferred it to the cumbersome remedies of a writ of right, or a writ of Novel Disseisin. By the Common Land Procedure Act, 1852, John Doe was abolished, and now an action for the possession of land may be brought by anyone entitled to such possession. See Land Laws.

Ejector. Appliance for operating a vacuum brake by exhausting or ejecting air from the brake cylinders. It consists of a pipe within an outer casing with an annular space between the two. When steam is admitted to the pipe, in the act of escaping at the outer end it draws the air from the annular space which is connected by piping to the brake cylinders. Valves are provided for controlling the amount of steam and air admitted. The ejector is fitted in the driver's cab, and is controlled by the engine driver, but valves are provided in guards' vans so that a guard can apply the brakes independently. The same principle is used in many ways for moving liquids.

An ejector pump is one used principally for the drainage of flat districts and works by means of compressed air supplied from a

central station. The pressure of the air forces the drainage through a system of valves, until it reaches its discharging point. See Brake; Injector; Pump; Steam Engine.

Eka (Skt., one). Word used by Mendeléeff as a prefix for a hypothetical element which filled a blank in his arrangements of chemical elements according to the periodic table. By extension, eka-iodoform was the name given to a sterile iodoform produced by mixing with iodoform a small proportion of paraform.

Ekaterinburg. Former name of the Russian town of Sverdlovsk (*q.v.*). Here Tsar Nicholas II and his family were assassinated on July 16, 1918.

Ekaterinodar. See Krasnodar.

Ekhmin, or AKHMIN. Town of Egypt. It stands on the Nile 70 m. above Assiut. For more than 2,000 years it has been the chief centre for the manufacture of the cotton shawls used by the natives. Here are the remains of a temple dedicated to Pan (the Egyptian Min), and other ruins, and an extensive Egyptian and Roman cemetery. In early Christian times Ekhmin was an important Christian centre. In the neighbourhood, near the village of Hawawish, have been found valuable papyri, including the "Gospel of Saint Peter." Pop. 28,000.

Ekron. Ancient town of the Philistines. It is the modern Akir, a small village in Israel, situated 23 m. W. of Jerusalem. A Jewish colony was established here by Lord Rothschild in 1884.

El. High god of the Phoenicians in the Ugaritic literature of the 2nd millennium B.C. He was king of the gods, lord of creation, and supreme judge of mankind, and bore a close relationship to the Hebrew High God of Biblical times (cf. Gen. 46, v. 3). Philo of Byblos identified him with Kronos of Greek mythology.

Elaeagnaceae (Gr. *elaia*, olive; *hagnos*, pure). Small family of shrubs and trees, natives of the N. temperate and tropical zones. They are more or less covered with silvery or brown scales. They have entire leaves, and small white or yellow flowers. The fruit is membranous, and enclosed in the tube of the calyx. The two best known species are the oleaster (*Elaeagnus*) and sea buckthorn (*Hippophaë*).

Elaeocarpus (Gr. *elaia*, olive; *karpos*, fruit). Genus of evergreen shrubs and trees of the family Elaeocarpaceae. Natives of the East Indies and Australia, they have alternate, lance-shaped or

oblong leaves, and small, white, fragrant flowers in sprays. The cherry-like fruit has a rough-shelled seed.

Elaeococca (Gr. *elaia*, olive; *kokkos*, seed). Genus of plants of the family Euphorbiaceae. They are natives of China and Japan. The seeds by pressure yield valuable oil, and those from *E. verrucosa*, a Japanese plant, are used for burning in lamps. From a Chinese species, *E. vernicia*, is obtained an oil useful for mixing paints.

Elaeolite (Gr. *elaia*, olive; *lithos*, stone). A variety of the mineral nepheline, theoretically a silicate of sodium and aluminium ($\text{NaAlSi}_3\text{O}_8$) but always containing excess silica and a little potash. Current usage tends to drop the name in favour of nepheline. Elaeolite generally occurs in massive form, rarely in coarse crystals; it is usually cloudy with minute inclusions and has a greasy lustre. It is characteristic of certain granular alkaline plutonic rocks. See Nepheline.

Elagabalus or HELIOGABALUS. Roman emperor A.D. 218-222. The son of Sextus Varius Marcellus and Julia Soemias he was originally called Varius Avitus Bassianus. He was born and brought up at Emesa in Syria, where at the age of 13 he was made priest of Elagabalus, the Syrian sun-god, and assumed his name. By pretending that he was the natural son of Caracalla, his grandmother, Julia Maesa, persuaded the legions in Syria to proclaim him emperor, under the name of Marcus Aurelius Antoninus.



Elagabalus,
Roman emperor
killed in the
Capitol, Rome

Abandoning the reins of government to his mother and grandmother, he devoted the first year of his reign at Rome to the introduction of the worship of the sun-god, represented by a large conical black stone which he had brought with him from the East. A sexual pervert, during his short reign he indulged in almost continuous debauchery. His attempt to murder his cousin Alexander, whom the senate had induced him to adopt as his successor, was frustrated by the praetorian guards, who took Alexander under their protection and murdered Elagabalus, March 11, 222.

Elaine. (1) Character in La Morte d'Arthur. She was the daughter of King Pelles and married Sir Lancelot. Their son was the blameless knight Sir Galahad, who achieved the Holy Grail. (2) The Maid of Astolat in Tennyson's Idylls of the King.

Elam. Ancient kingdom in S.W. Persia, comprising the plain of Susa in the valley of the Choaspes with the highlands of Anshan and Simash behind; sometimes the kingdom of Susa alone. The resemblance between Elamite and Sumerian painted pottery suggests that the Sumerians may originally have come from Elam. The origin of the Elamites is not known; they spoke a language neither Sumerian nor Semitic and their script was different from that of their Sumerian neighbours.

By the 3rd millennium B.C. Elamite kings ruled over wide territories from the Zagros Mts. to the Persian Gulf; the Akkadian rulers of Mesopotamia conquered Susa but after the death of Naramsin, Puzur-Inshushinak declared his independence and even invaded Sumer. The 3rd dynasty of Ur controlled Elam, but Kindattu of Simash captured Susa and Anshan, and destroyed Ur itself. Powerful rulers of Anshan and Susa defied Isin and held part of Babylonia till driven out by Hammurabi of Babylon. In the 13th century B.C. another great Elamite dynasty made itself master of the Tigris valley and western Iran to the sea; but the new Babylonian rulers drove them back, and Elam was in eclipse until the 8th century when it supported Babylonian national aspirations and was constantly involved in wars against Assyria until Ashurbanipal ravaged Elamite cities and razed Susa c. 640 B.C.; Elam became a province of the Assyrian empire and later fell into Median hands.

The Elamites of Acts 2 descended from Jewish settlers in Shushan, having no ethnic affinity with the native people.

Elan. River of mid-Wales. Rising in E. Cardiganshire, it enters the Wye after a course of 15 m. The watersheds of the Elan and Claerwen, its tributary, have been acquired by Bir-



Elaine, the beautiful daughter of King Pelles, in the Arthurian tales, as depicted by Mouat Loudon

By permission of the artist

mingham, and four reservoirs have been constructed on the Elan, whence the water is carried to the city by an aqueduct 74 m. long.

Eland. Genus of large antelopes, found only in Africa. They are the largest of all the antelopes, a fine bull standing nearly 6 ft. high at the withers. In colour, they vary from light fawn to grey, and the bulls usually have a thick tuft of dark hair on the forehead. Both sexes bear horns, about 2 ft. in length, and more or less twisted. They are found in most parts of E. Africa, but appear to be extinct in the South. They frequent wooded districts, and go in herds of fifty or more. Attempts have been made to acclimatise them in Great Britain, where they do well in parks, but they mature so slowly that they cost more in food than they are worth.

Elandslaagte. Village in Natal, known for an engagement in the early part of the S. African War. It is on the hills, 16 m. N.E. of Ladysmith, 3,614 ft. above sea



Eland. Specimen of the large gregarious antelopes found in most parts of East Africa

level. On Oct. 21, 1899, General French, with a small force moved out of Ladysmith to attack the Boer positions in the hills. He had with him only a few hundred men, but as the artillery duel was opening he realized that he was outnumbered and telephoned back for reinforcements. British battalions, Gordon Highlanders and Devons, were soon on the scene, also some Lancers and other cavalry, and the attack was pressed, the British advancing in open order up the hills. The Boer artillery was weaker than the British, and with a few casualties their position was taken. Some Boers resisted, but the majority rode away, while about 200 were made prisoners. The British lost 41 killed and 220 wounded; the Boers about 250.

Elasmobranchs (Gr. *elasmos*, metal plate; *branchia*, gills). A group of fishes, which includes sharks and rays. They are characterised by the possession of cartilaginous or gristly skeletons, though sometimes the cartilage is partly calcified. The scales are distant, and are homologous with the teeth in all vertebrates. The external gill openings are not protected by plates: the mouth is usually placed on the under side; there is no swim-bladder; and the two tail fins are of unequal length. Only the sharks and rays still exist. Marine in habit, they occasionally ascend rivers.

Elastic. Term more particularly used for a special fabric containing strands of rubber, usually made in the form of tapes, cords, and bands. The word is derived from an assumed Gr. form, *elastikos*, from *elaunein*, to drive, set in motion. See Elasticity; Rubber.

Elasticity. Property of matter in virtue of which it resists change in shape or bulk, and tends, after distortion, to recover its original shape or bulk when allowed to do so. Fluids have no fixed shape, and therefore no power to resist change of shape; they have no "elasticity of form"; but they resist compression and have "elasticity of bulk." Solids possess both kinds of elasticity.

An external force producing distortion in a body is known as a "stress" (strictly the force per unit area) and the distortion itself is called a "strain." The mathematical theory of elasticity deals with the various kinds of strain which a body may suffer, and the stresses corresponding thereto. If the strains are small, the general principle of the relation between stress and strain is "Hooke's

Law"—the stress is proportional to the strain it produces. It is generally assumed that the strain is small, as the elasticity of a solid has a definite limit (the "elastic limit"), and when the strain exceeds this limit it produces a permanent deformation, or actual fracture if the "yield-point" is reached. When a body is strained beyond the elastic limit by rapidly varying forces, it may be broken by a load less than the normal maximum.

Hooke's Law of Stress and Strain

A simple example of Hooke's Law is afforded by a steel wire stretched under the tension of a weight suspended from it. Hence the weight per unit area of cross-section is the stress, the longitudinal extension per unit length of the wire the strain, and it is found that for comparatively small strains the extension is proportional to the weight. Moreover, if wires of the same material, but of different lengths and thicknesses, are compared, the ratio of stress to strain is still constant, if each is measured on a suitable scale. For any given material, such as steel, the ratio of stress to strain is constant, and this constant number is called "Young's modulus" for the material. For steel wire it is about 13,000 tons to the square inch, and from this it is easy to calculate the longitudinal extension of a steel wire of any given length and cross-section, when stretched by a known weight.

In this case the wire suffers a change in volume as well as in form; the longitudinal expansion is accompanied by a slight lateral contraction, but the volume of the wire is on the whole increased. A strain in which there is pure change of form with no change of volume is known as a "simple shear"; it can be illustrated by twisting a wire. Here, again, for small twists the ratio of the "shearing stress" to the "shearing strain" is constant, this constant being known as the "rigidity." When a solid or a liquid is compressed, the ratio of the compressing force per unit of surface area (stress) to the proportionate diminution in volume (strain) gives another constant, the "volume elasticity," or "bulk modulus."

The theory of elasticity is of great importance to the engineer who has to deal in every kind of structure and machine with materials in various states of strain. See Materials, Strength of.

Elastic Limit OR LIMIT OF PROPORTIONALITY. When a metal



Elba. Fortress of Porto Ferrajo, the capital. Above the harbour is the palace of Napoleon I

or alloy is subjected to any stress, perhaps in tension, compression, or torsion, it becomes deformed. Up to a certain point, termed the elastic limit, the deformation is elastic; i.e. the metal will return to its original shape when the stress is removed. Once the stress exceeds this limit the metal becomes permanently distorted. The measurement of this property is important to engineers and is usually determined during a tensile test (*q.v.*).

Elastic Modulus. In a stress-strain curve, the ratio of the load to the extension of the metal, or more properly of the stress to the strain, before the elastic limit is reached. The figure for any particular metal or alloy is much the same, whether the strain is a change in length due to tension or in bulk due to compression. It is usually slightly lower in shear.

Elastic Recovery. When a steel is stressed beyond the elastic limit, it becomes plastically deformed. This lowers the elastic limit considerably and a small stress afterwards will produce a plastic change. But after several days the steel recovers its elasticity almost to the original value; this phenomenon is known as elastic recovery and the effect may be speeded up by heating to temperatures between 100–300° C.

Elaterite. Brown, rubber-like, bituminous substance of unknown chemical composition and origin. It occurs in joint and other planes in the carboniferous limestone of Derbyshire, the type locality being at Castleton.

Elatinaceae. Family of herbs and small shrubs, distributed generally over the globe. They are mostly small annuals, growing in marshes, with opposite or whorled leaves. The minute flowers have two to six sepals and a like number of petals, and the fruit is a membranous capsule, containing many seeds. Some of the plants are acrid, known as water-peppers.

Elba (Gr. *Aithalia*; Lat. *Ilva*). Island of the Mediterranean, belonging to Italy and included in the prov. of Leghorn. It lies 6 m.

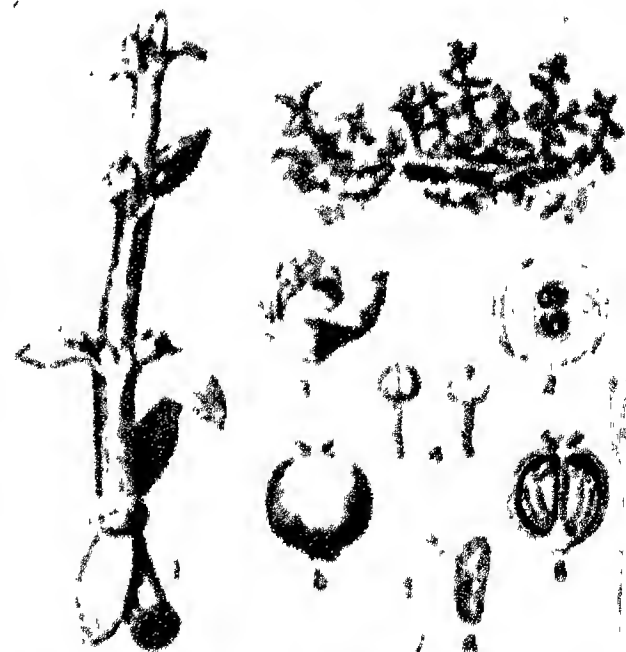
S.W. of Piombino, the nearest point on the mainland, and is 19 m. long by 6 m. broad, with an area of about 90 sq. m. It is wholly mountainous, rising to 3,350 ft. in Monte Capanne, with fertile valleys. The produce of the island includes iron, which has been

worked from antiquity, salt, granite, marble, chalk, and wine. Many of its fisher folk are engaged in the tunny and sardine fisheries.

The capital is Porto Ferrajo (*q.v.*) on the N. coast, the residence of Napoleon while in exile, May 5, 1814–Feb. 26, 1815. He had also a villa a few miles S.W. of the town and a country house on Monte Capanne. Porto Longone and Rio Marina are among the chief villages. Pop. 26,000.

In 453 B.C. Elba was laid waste by the Syracusans. It has belonged to Pisa, Florence, Spain, Naples, France, Tuscany, and since 1860 Italy. In the Second Great War Elba was garrisoned by Italians until the surrender of Italy in Sept., 1943, whereupon German troops occupied the island. French troops, supported by Allied warships and aircraft, landed at several points on June 17, capturing Porto Ferrajo next day. All organized resistance ceased on June 19. An attempted rescue that night of isolated Germans was frustrated.

Elbasan. Town of Albania. On the Skumbi, about 65 m. W. of Bitolj (Monastir), it is one of the few important towns of the country, and is the seat of a Greek bishop. It has hot sulphur springs. During the First Great War it was the headquarters for a short



Elatinaceae. 1. Flowering branch of *Elatine americana*, magnified. 2. Diagram of a dimerous flower. 3. A flower, more magnified. 4. A magnified stamen, outside and inside view. 5. Pistil, magnified. 6. Pistil, vertical section, showing placentas. 7. Transverse section of seed. 8. Magnified seed

time of a government formed by Essad Pasha, the Albanian notable who sided with the Allies. After their conquest of Montenegro and N. Albania, the Austrians occupied Elbasan, 1916-18. It gives its name to a prefecture. Pop. 13,796.

Elbe (Czech. Labe; anc. Albis). River of Europe. It rises in a number of streams which unite at the foot of the Schneekoppe, a lofty summit of the Giant Mts. (Riesengebirge), which extend along the N.E. boundary of Bohemia. From this mountain, at an alt. of 4,500 ft., it flows S. and W. to Melnik, the head of navigation, 21 m. N. of Prague. It penetrates the Mittelgebirge and the Erzgebirge, waters Saxony, and pursues a N.W. trend to fall into the North Sea, near Cuxhaven, through an estuary of 70 m. between Holstein and Hanover.

At its mouth it is nearly 14 m. in width, its length is 725 m., and its drainage area about 57,000 sq. m. It is navigable by small steamers for more than 500 m., as far as its junction with the Vltava (Moldau) at Melnik. The tide is perceptible as far as Geesthacht, about 110 m. from its mouth. Besides the Vltava, the chief of its many tributaries are the Havcl, Saale, Eger, and Mulde. The Elbe is linked by a series of canals with the Oder, the Spree, and the Trave, the last, opened in 1900, connecting Lübeck with Lauenburg. Hamburg, Magdeburg, Wittenburg, Torgau, Meissen, Dresden, Aussig, Leitmeritz, and Pardubitz are important places on its banks.

There is an enormous traffic along the Elbe, principally by barges, which are assisted by an ingeniously contrived towing chain. Immense quantities of timber are floated downstream from the forests of Bohemia. Fish include sturgeon, salmon, pike, and shad.

Before the Allies invaded Europe during the Second Great War many towns on the Elbe had been heavily attacked by Allied aircraft, Hamburg and Magdeburg being partially destroyed. In 1945 U.S. armoured formations of the 9th army made a lightning thrust across central Germany to the river, which was crossed on April 12. They established an 85-mile front along the Elbe from N. of Stendal to S. of Magdeburg, which was heavily bombed on April 17 and captured next day. German infantry, supported by tanks, launched counter-attacks at Barby. On April 19 about 10,000 Germans, with tanks, who had been cut off in the Harz pocket, made a surprise attack

behind the American lines in a desperate attempt to break through to the Elbe, one column advancing 15 m. to Koltze.

That day the British 11th armoured division cleared Lüneburg and reached the lower Elbe about 20 m. S.E. of Hamburg, and soon the British controlled a 35-mile stretch of the W. bank. U.S. 1st army troops were N.E. of Dessau by the 24th, and next day contact was established between the U.S. and Russian armies on the Elbe near Torgau. A British force crossed the river near Lauenburg, capturing the town and establishing a bridgehead, while the U.S. 82nd airborne division made another crossing upstream at Bleckede. Between the Weser and the Elbe the Guards armoured division was engaged in clearing the Cuxhaven peninsula.

On April 30 troops of the U.S. 9th army broke out of the Barby bridgehead and linked with the Russians at Apollensdorf. The British and American bridgeheads on the lower Elbe were joined by May 2, controlling 50 m. of the river, while two thrusts were made to the Baltic. On the 3rd the defence system in N.W. Germany collapsed and Hamburg surrendered to the British 2nd army, all German forces in this area surrendering unconditionally to the 21st army group next day. The Guards armoured division entered Cuxhaven on May 7, and the U.S. 9th army withdrew from territory E. of the Elbe in accordance with the demarcation agreement with Russia. Dresden was entered by the Russians on May 8.

Elberfeld. This industrial town in N.W. Germany, with its twin town Barmen, is described under Wuppertal (*q.v.*).

Elbert. Granite mt. of Colorado, U.S.A. The highest peak of the Sawatch group of the Rockies, having an alt. of 14,421 ft.

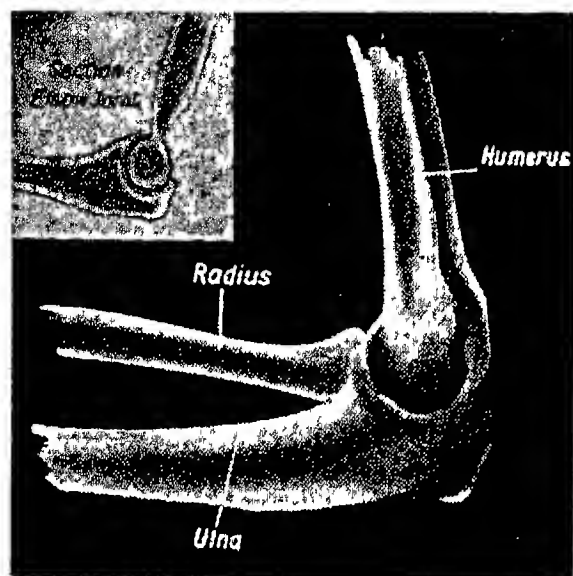
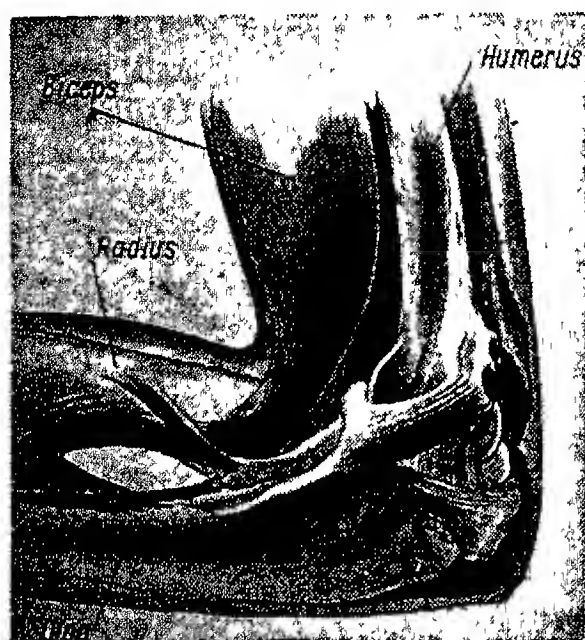
Elbeuf. Town of France. It stands on the left bank of the Seine, in the dept. of Seine-Maritime, 12 m. S.S.W. of Rouen. Across the river is the suburb of St. Aubin. The chief buildings are the Renaissance churches of S. Jean and S. Etienne, and the town hall. There is a museum, and several technical and other schools. The main industry is the making of woollen goods. Elbeuf gives its name to a forest around the town, and at one time there was a duke of Elbeuf. Occupied by the Germans in the middle of June, 1940, the town was included in the German-occupied zone after the defeat of

France. It was liberated by troops of the 1st Canadian army, Aug. 25, 1944. Pop. (1954) 17,293.

Elbing (Pol. Elbląg). German and familiar name of a town of Olsztyn (Masuria), Poland, formerly in E. Prussia. Elbing is on the Elbing river and a canal linking it with the Vistula, 5 m. from the Baltic, in the Frisches Haff, and 45 m. E.S.E. of Danzig. Its main importance was derived from a shipyard, and during 1934-45 from motor-car, locomotive, tractor, and cigar factories; it also had engineering, furniture, and chocolate industries. Founded 1237 by Lübeck merchants around a castle of the Teutonic Knights, it was a member of the Hanseatic League, broke with the knights in 1454 and accepted Poland's protection, fell to Prussia in 1772, and then recovered part of the importance it was losing to Danzig. The old town had the remarkable R.C. church of St. Nicolas (13th century), S. Mary's (13th-16th), Corpus Christi (13th), S. George's chapel (14th). Elbing had a short-lived prosperity when Hitler started a new navy; torpedo boats and U-boats were built here, and an unfinished aircraft carrier lay in its docks when the town was taken by the Russians on Feb. 10, 1945, after violent fighting. The town came under Polish administration by the Russo-Polish treaty of Aug., 1945.

Elbow. Joint formed by articulation of the lower end of the humerus, or upper arm bone, with the radius and ulna, the two bones of the forearm. The articulation between the ulna and the humerus forms what is termed a hinge-joint, a deep notch in the ulna, the greater sigmoid cavity, gliding backwards and forwards over the trochlear surface of the humerus. The disk-shaped head of the radius contains a depression which articulates with a prominence on the humerus termed the *capitulum*; the edge of the disk articulates with the small sigmoid cavity of the ulna. These articulations permit the rotation of the forearm. The tip of the elbow is formed by a process of bone called the olecranon; the bony prominences, which can be felt on the inside and outside of the elbow when the arm is held with the palm of the hand facing forwards (supination), are the internal and external condyles of the humerus.

INJURIES TO THE ELBOW. These may involve both radius and ulna together, or only one bone. The most frequent dislocation of the



Elbow. Diagram showing the three bones forming the joint; above, relations of the bones and muscles

two bones together is backwards, and may be associated with fracture of the olecranon, or the coronoid process, a prominence which forms the lower part of the greater sigmoid notch. This condition is accompanied by pain, swelling, and changes in the relative positions of the bony joints to each other, the forearm being kept partially bent and the hand held midway between supination and pronation, i.e. between complete external and internal rotation. The dislocation can usually be reduced without much difficulty by skilled hands, but patients should not be encouraged to reduce dislocations themselves.

Dislocations of both bones forwards or sideways are much less frequent. When a single bone is dislocated it is more frequently the radius, since the articulation between it and the humerus is less firm and close than that between the ulna and the humerus. In forward dislocation of the radius the head of the bone rests against the front of the lower end of the humerus, which prevents the patient from completely bending his elbow. The surgeon pulls the forearm forwards while it is bent at a right angle, and at the same time presses the head of the bone back into its place.

Sprain of the elbow, or "pulled elbow," is an accident not infrequent in young children, in which

the head of the radius slips down, and one of the ligaments becomes nipped between the radius and humerus. The doctor replaces it by bending the limb and then extending it. Fractures of the bones forming the elbow-joint frequently complicate dislocation. The humerus may be broken across just above the condyles, or either condyle may be fractured.

DISEASES OF THE ELBOW. Tuberculosis of the elbow is more frequent in children than in adults. The joint becomes swollen and painful, and chronic abscesses form which may extend to the surface and break through the skin, thus giving rise to a sinus. Treatment consists in keeping the limb at rest and building up the general constitution. Sometimes surgical measures are appropriate. Arthritis of the elbow joint may be the result of septic or gonorrhoeal infection. Synovitis, which may be acute or chronic, is inflammation of the synovial membrane which lines the joint. Inflammation and enlargement of the bursa, which lies over the olecranon process, gives rise to the condition known as "miner's elbow."

Tennis elbow is an incomplete tear of the triceps tendon at its insertion on the bone. It occurs suddenly when the handling of a tennis racket throws undue strain on the muscle. The treatment is rest and massage after the surgeon has completed the tear.

Elbruz. Mt. of Georgia S.S.R., highest in Europe. It lies a little to the N. of the main Caucasus chain, and consists of two extinct volcanic peaks, the higher being 18,467 ft. Elbruz formerly lay in Kabardinia A.S.S.R., but in 1943 the frontier was re-drawn so that the highest mountain in Russia should fall within Georgia, country of Stalin's birth. Elbruz was first ascended in 1829. According to tradition, it was the first resting-place of the Ark.

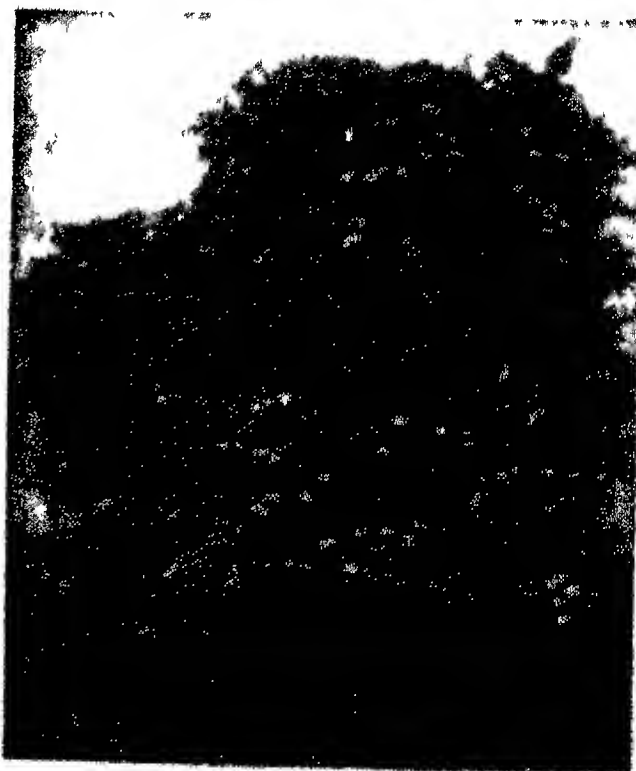
Elburz. Mountain range skirting the S. shore of the Caspian. It extends for a length of 600 m., and to a width in places of 200 m., through N.W. Persia. On its N. slopes are fertile valleys, and at various points naphtha and petrol are found in considerable quantities. The highest peak is the volcano, Mt. Demavend (q.v.).

Elche. Town of Spain, in the prov. of Alicante. It stands on the Vinalapo, 13 m. by rly. S.W. of Alicante. Of Moorish appearance, with flat-topped white-washed houses, open squares, and narrow streets, the town is nearly surrounded by plantations of date

palms, the fruit being exported as "Barbary" dates. It has an ancient castle of the duke of Altamira, and a handsome church (Santa Maria), with a beautiful blue-tiled dome. An important rly. junction, it carries on a trade in figs, olives, almonds, and exports esparto grass, mats, and rope shoes. Santa Pola, its port, lies 2 m. S.E. At the feast of the Assumption a 14th century religious drama with music is performed. Pop. (1950) 55,877. *Pron.* el-chay.

Elchingen. Village of Germany, in Bavaria. It stands on the Danube, 8 m. N.E. of Ulm, and is famous for the battle fought there between the French and the Austrians, Oct. 14, 1805. This was part of the campaign that ended in the capitulation of the Austrians at Ulm and their defeat at Austerlitz. The two armies met at the bridge which here crosses the Danube, and which was then in ruins. The French, however, quickly remade it, and the army got across. The Austrians under Mack were already demoralised, only one part of the army stood to fight, and this was hampered by difficulties of every kind. The chief feature was the surrender of a large number of Austrians. Ney was made duke of Elchingen as a reward for his services there. See Ulm, Campaign of.

Elder (*Sambucus*). Group of hardy shrubby trees, natives of Britain, of the family Caprifoliaceae.



Elder. A large specimen of *Sambucus nigra* in bloom

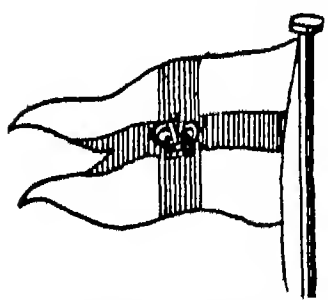
Their height is about 10 ft.; the flowers are white and variegated. They can be grown in any ordinary soil in open shrubberies. There are a few varieties of *S.* European origin, but they are rarely seen to advantage in British shrubberies. They are propagated by cuttings in autumn or spring. *S. nigra* is the familiar native elder, the

berries of which are used for the manufacture of home-made wine. A liquid distilled from the flowers, elder-flower water, is used for flavouring confectionery. Owing to its lightness, the pith is made into balls much used in electrical experiments.

Elder. Word used in a civil and an eccles. sense for an overseer. Of frequent occurrence in the Bible, in the O.T. it is applied to the heads or representatives of tribes and families, especially of the Israelites, as the word sheikh is among the Arabs. In the N.T. it is used to define officers of the Church who originally may have been identical with the bishops. Certain office-bearers in the Presbyterian and other churches are called elders. The word alderman (*q.v.*) is a familiar English equivalent of the word. See Bishop; Kirk Session; Presbyterian.

Elder Brethren of Trinity House. Members of the Corporation of Trinity House (*q.v.*), Tower Hill, London, E.C.3. The deputy master and the active Elder Brethren are all chosen from men who have served as officers in the Royal Navy or as master mariners in the Merchant Navy. Distinguished persons, *e.g.* members of the royal family and prominent statesmen, may also be elected as honorary Elder Brethren. The active Elder Brethren assist, when required, the judges of the admiralty court as nautical assessors in shipping cases.

Elder Dempster Lines Limited. British steamship line. Formed in 1932 to take over the



Flag of Elder Dempster Lines Ltd.

business of several shipping companies engaged in the West African trade which had been managed by Elder Dempster and Company, notably the African Steam Ship Company, founded 1852, and the British and African Steam Navigation Company, founded in 1868 by Alexander Elder and John Dempster and reorganized in 1910.

The principal services are the United Kingdom/the Continent/the United States of America, to and from West Africa (mail, passengers, and cargo), and a coastal service between West and South Africa. Other services are maintained between Canada and South, East, and West Africa, and between India and West Africa. In 1939 the company owned 42

sea-going vessels of which 26 were lost during the Second Great War.

The head office is at India Buildings, Water Street, Liverpool; there is a London office at Dunster House, Mark Lane, E.C.3.

Eldon, JOHN SCOTT, 1ST EARL OF (1751-1838). British lawyer. He was born at Newcastle-upon-Tyne, June 4, 1751, son of a coal merchant. He was educated at the town grammar school, and University College, Oxford, where he was for a time a tutor. He did not, as at first intended, enter the Church, but in 1776 was called to the bar and soon began to practise in London; in 1782 he became a K.C.



Eldon
After Lawrence

That year Scott entered parliament as M.P. for Weobley. He forced himself into notice by frequent speeches, and in 1788 Pitt made him solicitor-general. In 1793 he was promoted attorney-general, and in 1799, having conducted the prosecution of Horne Tooke and others holding republican ideas, he was made chief justice of the court of common pleas, and a peer, as Baron Eldon. Lord chancellor from 1801, he left the post on Pitt's death in 1806, but in 1807 returned to fill it for 20 years, a longer period than any other chancellor. He was the most powerful man in Lord Liverpool's reactionary cabinet, and his methods are a classical example of caution and dread of innovation. He resigned in 1827 and died Jan. 13, 1838.

Eldon married Elizabeth Surtees, the daughter of a banker, having run away with her in 1772. His two sons died before him, and his titles—he had been made an earl in 1821—passed to his grandson John (1805-54). A descendant, John (b. 1899) became 4th earl in 1928. The eldest son is known as Viscount Encombe. Eldon's elder brother, William Scott, a distinguished lawyer, was in 1821 created Baron Stowell. Consult *Lives of the Lord Chancellors*, Lord Campbell, 3rd ed., 1848.

El Dorado (Span., The Gilded One). Name successively applied to a gilded man, a golden city known as Manoa or Omoa, and a region abounding in gold and precious stones, reputed to exist

in S. America. The El Dorado legend apparently originated in a custom said to have been observed by an Indian tribe dwelling on the tableland of Bogotá at the installation of a new chief. His naked body, after being smeared with balsam, was covered with gold-dust, and he plunged into the sacred lake of Guatavita, whilst the assembly cast gold and precious stones into the water.

The Spaniards in America put such faith in the El Dorado legend that the governors of Guiana were styled also governors of El Dorado. They organized many fruitless expeditions in search of the legendary city, Manoa, the earliest being led by a German governor of Guiana, Ambrose Dalfinger, in 1529. In 1595 Sir Walter Raleigh claimed to have located Manoa on an island in Lake Parima, but this lake was proved by the 19th century German traveller, von Humboldt, to be non-existent. The name El Dorado came to be applied to any place reputed to abound in easily acquired wealth.

Eleanor OF AQUITAINE (c. 1122-1204). Queen of Henry II of England. The eldest daughter of William, duke of Aquitaine, her first husband was Louis VII of France, to whom she was married in 1137. Her dowry was the great duchy of Aquitaine. In a short time Eleanor and Louis were on bad terms, and in 1152 the marriage was dissolved. In the same year she married Henry of Anjou, who became king of England in 1154. She was the mother by Henry of the quarrelsome princes who disturbed his reign. Indulgent to them, the queen was concerned in the revolt of 1173. She moved about in France trying to help John in his fight against Richard I. She died April 1, 1204. Consult *Life*, C. B. Reed, 1928.

Eleanor OF CASTILE (d. 1290). Queen of Edward I of England. The daughter of Ferdinand III, king of Castile, she was married to Edward in Oct., 1254. She fled to France in 1264 when her husband was worsted by the barons, and was in Palestine with him in 1270. She died at Harby, Notts, Nov. 28, 1290, and was buried at Westminster. The king erected crosses, known as Eleanor crosses, at the places at which her body rested on the journey—Lincoln, Grantham, Stamford, Geddington, Northampton, Stony Stratford, Woburn, Dunstable, S. Albans, Waltham, Westcheap, Charing Cross; three survive (Geddington, Northampton, Waltham).

Eleanor of Provence (d. 1291). Queen of Henry III of England. The daughter of the count of Provence, she was brought up amid the poets and troubadours there. In 1236 she was married to Henry at Canterbury. Throughout her residence in England she was most unpopular. The charges against her resolve themselves into a love of foreign relatives and avarice. In 1276 she entered a religious house at Amesbury, where she died June 25, 1291. Consult *Queens of England*, A. Strickland, vol. i, 1840.

Eleatic School. One of the chief pre-Socratic Greek philosophical schools. It was founded by Xenophanes of Colophon at Elea in Lucania in lower Italy; its other chief representatives were Parmenides and Zeno (both of Elea), and Melissus of Samos. The kernel of their doctrines was the unity and unalterableness of Being (that which really had a right to the name of existence), the unreality of Becoming (material changes), of Plurality, and of sensual perceptions. The real nature of things, they held, cannot be perceived by the senses, but is attainable only by thought. All that is given us by the senses is mere appearance. Since the senses show us only plurality and the manifold, and since the separate parts of the world, such as it presents itself to our senses, both differ in themselves and are subject to constant change and movement, they asserted that Being was only one, unchangeable, and immovable. Only Being is; non-Being is not; there is no Becoming. Starting from the assumption that the idea of real Being excludes anything contradictory, the Eleatics argued that Plurality, and above all Movement, could be neither Being itself nor found in connexion with Being.

Election (Lat. *electio*, choice). Term used in English law. A man has sometimes to choose which of two courses he will take. Thus, if A. B. sells me first quality oats and delivers second quality, I can either reject them altogether or keep them and pay for them, counter-claiming for breach of warranty of quality. But I cannot keep the oats and decline to pay. If I do not forthwith reject them I have elected to keep them. Again, circumstances sometimes arise when one has to choose, or elect, whether one will retain the benefit of a gift *inter vivos* (among the living), as, for instance, under a marriage settlement or a deed of appointment;

or give it up and take a benefit under a will. Election implies knowledge; that is, a man can elect only where he knows his rights.

Election. Term used in theology for the doctrine that God from eternity has chosen certain persons for eternal life. In the O.T. the term elect is applied to the Israelites, as the chosen people of God. In the N.T. the members of the Christian Church are called the elect in 1 Peter 2, and in S. Paul's epistles to Thessalonians, Colossians, and Timothy. The Calvinistic view that God has elected certain persons to be saved and others lost, and this solely by His own will and irrespective of any merit or demerit in the individuals, was never held before the Reformation. The usual view was to identify the elect with the baptized, in the sense that they had been chosen and called to a Christian profession; but to recognize the possibility of falling away from such a profession. Only those who persevered in Christian living to the end could be regarded as the people whom God had foreknown and chosen from the beginning as His faithful followers. The Catholic Church has never maintained that election of the faithful implied condemnation of those denied the opportunity of election.

Election. In politics, and to some extent in business, the choosing of representatives. The methods of election vary, but usually a bare majority of votes is sufficient to secure election, although this may be either a majority of the votes cast, or a majority of those entitled to vote.

The first elections were decided by the casting of lots, a method in force among the Greeks and Romans, but later ideas were averse to this. Election by the votes of the electors began with the growth of the idea of representation. In the 12th century, perhaps earlier, the reeve and four men represented the village communities of England on occasions, and in some rough manner these four men were elected by those for whom they spoke. The system grew with the growth of parliamentary institutions; knights of the shire, and burgesses for the boroughs, were elected, as well as other officials. Until modern times the method was rough; those present held up their hands, or shouted, much as they do at a public meeting today, and it was the sheriff's duty to declare which men were thus elected.

There is proof that the sheriffs abused their power, declaring the election of persons not rightly chosen, and checks upon them were introduced. For parliamentary elections there came in the method of open voting on the hustings (*q.v.*) and then the present system, which belongs to the 19th century. It includes voting by ballot, a careful enumeration of the votes cast, and, if necessary, a scrutiny and recount; indeed, every possible device to secure that the wishes of the voters prevail.

British parliamentary elections are divided into general and by. A general election is one held at a stated time after the dissolution of parliament. A by-election takes place when death or some other cause renders a seat vacant. In elections for many local bodies, e.g. bor. councils in England, it is customary for one-third of the members to retire every year, so there is never a general election. County councils in England have a full election every third year.

There is a fundamental division between direct and indirect elections. In the former the voters themselves choose their representatives, each voter having as many votes as there are members to be elected. Elections to the house of commons are the best known of this kind. At indirect elections the electors choose certain men who, in their turn, elect the actual representative. The most notable existing instance of this kind is the choosing of the American president by a college of electors. The Venetian republic had an elaborate system of indirect election when choosing a doge. The election of aldermen in English boroughs and county councils is a somewhat different kind of indirect election; they are chosen from among themselves, or from outsiders of noted public service, by the directly elected councillors.

Elections at the best are but a crude test of the people's will, so vast are the numbers engaged, and so great the possibilities of manipulation. It has happened more than once that a minority of voters return a majority of members to the British house of commons. To make this impossible, and also to secure the representation of minorities, various proposals—proportional representation, second ballot, alternative vote—have been put forward.

At elections of company directors a show of hands is usually sufficient, but, under certain con-

ditions, those dissatisfied with the decision can demand a poll. In elections of this kind, unlike political ones, the shareholders have votes in proportion to their interest in the company. A further device prevails at elections of members to clubs and societies. There a small number of members can keep out a candidate by voting against him; this is called blackballing, from the practice of using black balls for this purpose. Election is the term used for the choice of fellows or scholars at the colleges of Oxford and Cambridge. Professors are also usually elected. See *Alternative Vote*; *Ballot*; *General Election*; *Hustings*; *Proportional Representation*; *Vote*.

Electoral Commission. Name given to the body of men created by an act of Congress in the U.S.A., Jan. 29, 1877, to settle certain disputed questions in connexion with the electoral votes of four states in the presidential election of 1876. It was the only disputed election in American history. It was decided to create a commission to determine which of two or more conflicting certificates received from any state of the votes cast by the electoral college of such state for president and vice-president in the 1876 election was the certificate provided for in the constitution. The judgement in each case was that the certificate of the votes cast for Rutherford B. Hayes and William A. Wheeler, the republican candidates for president and vice-president respectively, was the certificate containing the lawful electoral vote of the said state. The other certificates were declared void. The electoral votes were then counted, and Hayes and Wheeler were declared elected.

Electoral Roll. List of electors in a parish of the Church of England. They may be of either sex, but not less than 18 years old, baptized, and declaring themselves to be members of the Established Church and of no other religious body. If residing in another parish, a person can qualify by attending for one year at public worship at the church. Duties are exercised at the annual parochial church meeting.

Electoral Truce. Cessation of rivalry at the polls between opposing political parties. In a three-cornered fight at an election the two parties most closely related politically may come to an arrangement by which one will agree not to contest the seat, thereby avoiding splitting the votes. The term was also used

during the Second Great War to indicate that parties which broadly supported the National government would not oppose one another at by-elections.

Electors. Term used in two special senses. (1) The German princes who in the Holy Roman Empire voted at the election of the king. Like many other early peoples, the Germans elected their kings; but, unlike them, they retained this practice—at least, in theory—until modern times. These elections may be said to have begun with the choice of Conrad I as king in 911, but it was often merely a form, the eldest son of the late king being confirmed as ruler, as was Otto the Great. The electors were powerful when there was no obvious successor to the throne, two or more candidates claiming it, as in 1198, and more so after the death of Frederick II in 1250. At first all the princes took part, or were entitled to take part, in the elections, but soon many of them ceased to attend. In 1257 the number taking part was seven. This number became fixed, was recognized by the pope, and at Aix-la-Chapelle statues of the seven were erected.

Trouble then arose as to who were the favoured seven. The archbishop of Mainz and the elector palatine of the Rhine were acknowledged to be electors, but in other cases there were difficulties, especially when two men divided a duchy between them. The matter was settled in the Golden Bull issued by Charles IV in 1356, which fixed the number at seven, who were named. Three were archbishops—Mainz, Cologne, and Trèves—and the other four were the elector palatine, the duke of Saxony, the margrave of Brandenburg, and the king of Bohemia. Each held an office at the emperor's court. The clerics were archchancellors for his three kingdoms, Germany, Italy, and Burgundy; the elector palatine was his steward, Saxony his marshal, Brandenburg his chamberlain, and Bohemia his cupbearer. The archbishop of Mainz was president of the electoral college, and on the death of a king summoned the electors to Frankfort.

The power of the seven electors was greatly increased by the Golden Bull. They were made almost sovereign rulers, with privileges not enjoyed by the other princes of Germany. They formed a college, one of the three sections of the imperial diet. The com-

position of the college remained unchanged until 1623, when the elector palatine lost his vote, which was given to the duke of Bavaria. In 1648 he was restored as an eighth elector. A ninth electorate was created in 1708 for the ruler of Hanover, and this was held by George I and other English kings. To keep up the old theory these new electors also held offices, the elector palatine being treasurer and Hanover standard-bearer. In 1778 the ruling family of Bavaria became extinct, and the elector palatine secured its lands, thus uniting two votes. In 1806, with the dissolution of the empire, the electors ceased to exist. (See *Empire*; *Germany*; *Golden Bull*.)

(2) In the U.S.A., persons chosen by popular vote to elect the president. In Nov. of every fourth (leap) year, voters throughout the U.S.A. go to the polls to choose the electors whose sole task it will be to give their votes at their respective state capitals in Dec. for the presidential candidate approved by their party. Each state chooses as many electors as it sends senators and representatives to congress. Theoretically, an elector is left free to vote for the candidate whom he honestly thinks is the best man; but in practice it is inconceivable that a Democratic elector could vote for a Republican candidate, or vice versa. Whatever the balance of votes in the electoral college of any one state, the whole quota of that state's votes is cast in favour of the candidate chosen by the majority of electors. The vice-president of the U.S.A. is elected by similar machinery.

Electra. In Greek mythology, daughter of Agamemnon and Clytaemnestra. She incited her brother Orestes, when he grew up to manhood, to murder his mother, Clytaemnestra, in revenge for the latter's murder of his father on his return from Troy. The tragic life of Electra forms the subject of tragedies by Sophocles and by Euripides.

Electrical Engineers, INSTITUTION OF. British professional body, founded (as the Society of Telegraph Engineers) in 1871. It was incorporated by royal charter in 1921; its membership in the mid-1950s exceeded 40,000. The institution has many local centres and sub-centres in Great Britain and Northern Ireland, and branches or oversea groups in the Irish Republic, Argentina, Australia, Calcutta, Ceylon, Hong Kong, India, Iraq, Malaya, New

Zealand, Singapore, South Africa, Trinidad, and West Africa. Its head office is in Savoy Place, London, W.C.2.

Electrical Units. Unit of electric pressure, the volt; of current intensity, the ampere; of resistance, the ohm; of power, the watt. Each unit is described under its own heading.

Electric Arc. A luminous discharge of electricity through air or gas which is in a state of ionisation (*q.v.*) thus rendering it temporarily conducting; or such a discharge in a conducting medium formed by a bridge of minute particles of its own electrodes heated to incandescence. Examples of the former are the luminous discharges in fluorescent lamps, where the arc is conducted by ionised atoms of mercury, sodium, or other vapour at a low pressure. An example of the second type is the carbon arc lamp.

An arc once established can be maintained by a difference of potential between electrodes of as little as 30 volts, and should not be confused with an electric spark, which breaks down a gap between two electrodes and requires several thousand volts to cross a gap as short as a millimetre. In the carbon arc lamp, in the arc furnace for melting metals, and in electric welding the production and maintenance of the arc are the primary object.

Electric Charge. Term used for certain states of electrification of a body. When two substances (insulated if conductors) are pressed hard or rubbed together and then drawn apart, they are found to have developed properties which they did not apparently possess before, the chief being the power of attracting each other and light particles of other substances. They have acquired an electric charge and are said to be electrified.

All bodies seem able to develop or acquire such a charge more or less, but if different substances so charged be examined the remarkable fact emerges that, while the charges have certain properties in common and act in accordance with the same laws, there are two different kinds, one kind being developed by certain classes of substances and the other by other classes, with the qualification that either kind may be developed on some substances according to the material with which they are rubbed. The two kinds of charge are represented by that developed on a glass rod when rubbed with

silk, and by that produced on a stick of resin when rubbed with fur or wool; the former is called positive electricity and the latter negative electricity. A characteristic of these charges is that one is never developed by itself but both are always produced at the same time, one kind being found on the body rubbed and the other kind on the material with which it is rubbed. *See* Electricity.

Electric Discharge. An escape or discharge of electricity that travels through a gas at normal or rarefied pressures. The earliest observed discharges were those passing through or into the atmosphere; *e.g.* from an electrified cloud, or from the metal cylinder of an electrical machine. There are four types of electric discharge:

(1) Spark discharge, or lightning. This is a sudden release of energy between oppositely charged conductors caused by the breakdown of the insulating air between them.

(2) Brush discharge, a short bright streak coming from the positive electrode and splitting up into many branches, which grow fainter as they leave the parent stem until they finally disappear in air. It occurs when the voltage is less than sufficient to spark.

(3) Glow discharge, or corona, observed when the diameter of a conductor or part of it is so small relatively to the voltage of the charge that the air in contact with the surface continuously breaks down; the discharge resembling a thin coating of luminous fur.

(4) Discharge through a rarefied gas (seen in nature as the aurora) or through a vacuum tube as in a fluorescent lamp, when the electron discharge has become invisible but causes the glass to fluoresce. *See* Electronics; Gas-Discharge Tube; Neon Lighting; Radar; Television.

Electric Fish. Group of fishes possessing the power of administering an electric shock. There are three kinds: the electric eel (*see* Eel, Electric); the African catfish; and the torpedo, a species of ray, which is the most numerous.

The electric catfish (*Malapterurus electricus*) is found in all the larger rivers of Africa, the finest and most powerful occurring in the Nile. It attains a length of four feet and frequents the darker and more sluggish portions of the streams, where it kills or stuns other fish, which it eats. In some catfish the electrical power seems present all over the body, in others just under the skin at each side.

A considerable number of species of the torpedo occur in the warmer seas of the world. The best known is the *Torpedo marmorata* of the southern shores of Europe and of the Mediterranean; large specimens may weigh 80 lb.

The muscles and the nerves concerned in the exercise of the electrical power of these fish are known; but the source of the power and how the organisms become charged with it is not known. Its exercise evidently calls for much nervous force, as after a powerful shock or a series of shocks has been given the fish is exhausted, and must rest.

Electric Furnace. A furnace heated by electric power. Davy used the first electric furnace to produce metallic sodium and potassium and in 1839 Hare made graphite and calcium in a small one. But not until there was available an abundance of cheap electrical power were they practicable in industry. Localisation of heat, lack of fumes, rapid heating, fewer heat losses, and high temperatures are among their many advantages. The electrical energy is used wholly for heating except in electrolysis of fused salts. Small laboratory furnaces are usually heated by resistance. A conductor of high resistance is built into the furnace and the charge is heated indirectly.

Large electric furnaces used for alloy steel manufacture are usually of the arc type. When two electrodes are brought into contact, current begins to flow; if the electrodes are then moved slowly apart, the current continues to flow across the gap, being carried by vapour, volatilised from the heated tips of the electrodes. Carbon, which volatilises at about 3,500° C., is often used for electrodes. Indirect arc furnaces have electrodes through the sides, the charge being heated by radiation.

Low- and high-frequency induction furnaces are used for non-ferrous metals. A low-frequency furnace of the Ajax-Wyatt type operates on the transformer principle. A primary coil is inserted in the bottom of the furnace and molten metal is run into a channel round it to form the secondary coil. The top of this ring is open into the body of the furnace and when the current passes it becomes rapidly heated, the hot metal circulating into the cold charge. High-frequency furnaces use comparatively weak magnetic fields at frequencies between 500 and 2,000 cycles per second or higher.

ELECTRICITY: HISTORY AND THEORY

D. F. Aiken and David Le Roi

This article forms an introduction to the history and theory of electrical phenomena, and explains the basic principles which govern the practical application of electricity in industrial, domestic, and scientific fields. It is followed by articles on various specialised uses of electricity. See also Alternator; Cell; Dynamo; Radio; etc.

Greek philosophers had known in the 7th century B.C. that a piece of amber when rubbed rapidly with a dry cloth would pick up small straws and pieces of chaff. For over 2,000 years nothing further was learned about this mysterious phenomenon, until in 1600 the English physician William Gilbert (1544–1603) published in his book *De Magnete* the results of a number of systematic experiments. He gave the name "electric attraction" to the phenomenon, from the Lat. *electrum*, Gk. ἡλεκτρον, amber. Gilbert demonstrated that electric attraction could be produced by rubbing other substances besides amber, e.g. glass, sulphur, hard resin, sealing-wax, mica, rock salt, and diamond, and that almost any light object might be attracted, though not flame or air.

Incidentally, an attraction between the rubbed substance and the substance attracted to it is mutual. Thus, if a piece of sealing-wax is rubbed with a cloth, the sealing-wax will attract the paper, but it is just as correct to say that the paper attracts the sealing-wax.

By the early 18th century it was discovered that there were effects of repulsion as well as of attraction. A glass rod, electrified by rubbing with silk, and suspended by a fine silk thread, would be attracted by a piece of sealing-wax rubbed with fur, but would be repelled by another piece of glass rubbed with silk. In 1734 the French physicist Charles du Fay (1698–1739) explained this by suggesting that there were two kinds of electricity: "vitreous" on glass and "resinous" on sealing-wax. They were thought of (like heat) as imponderable or weightless fluids. An excess of either in a body constituted a charge, but if both kinds were present in the same body they tended to neutralise each other. All charged bodies attracted uncharged bodies; but among charged bodies, only unlike charges attracted: like charges repelled each other. The phenomena, however, could also be explained in terms of a single electric fluid, of which an excess produced the effect of one kind of charge, a deficit of the other. On this basis Benjamin Franklin (1706–1790)

in 1747 gave the name "positive" to vitreous electricity, "negative" to resinous electricity. These terms are still in use, although in current electronic theory it would be more logical to apply them the other way round.

Two other notions informed most of the 18th-century discoveries about the behaviour of elec-

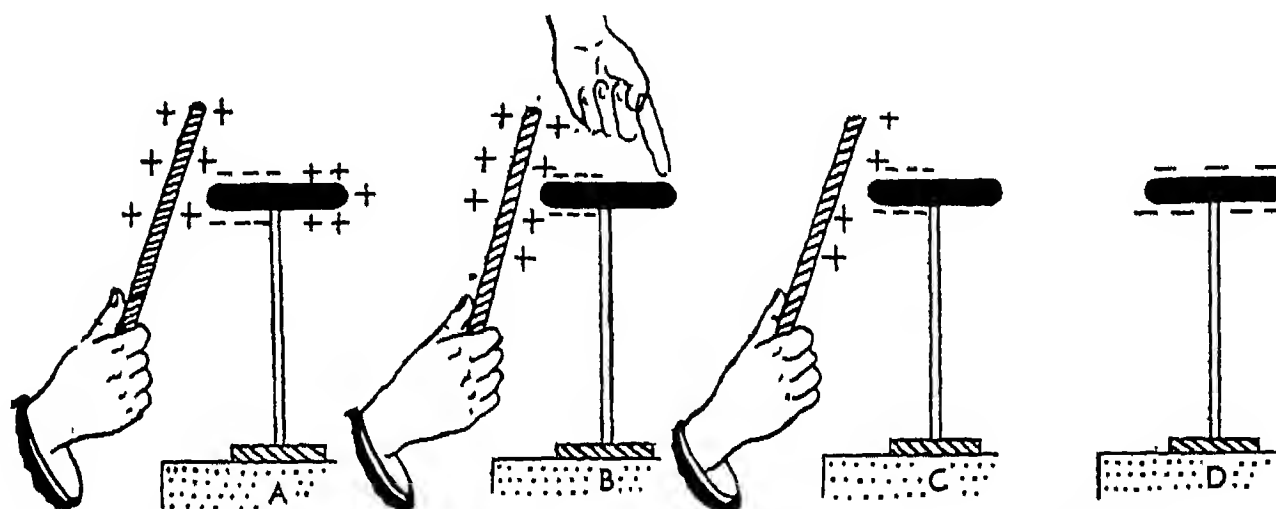


Fig. 1. Charging an insulated conductor by induction. For explanation see text below

tric charges. One was the distinction between conductors and insulators, which seems to have been first formulated in 1729 by Stephen Gray (1650–1736). The other was the conception of electric influence (later called electrostatic induction) as the means whereby a charge on one body gave rise to charges on neighbouring but (apparently) unconnected bodies.

ELECTRIC CHARGES. If a glass rod, which has been positively charged by rubbing with silk, is brought near to an insulated conductor, a negative charge will be induced on the near side of the conductor, a positive charge on the far side (fig. 1). On the two-fluid theory it was said that the charges on the conductor had been separated; on the one-fluid theory, that whereas previously the electricity had been evenly distributed over the conductor, now some of it had been repelled to the side remote from the rod (a), thus producing a positive charge there and leaving a deficit or negative charge on the side nearer the rod. If the conductor is now touched with the finger (or an earthed wire) the positive charge is repelled even farther (b): in fact it escapes to earth (c); so that if first the finger, then the glass rod are removed, the conductor is left with a negative charge on it (d). A positive charge is produced by using an

ebonite rod rubbed with cat's fur.

Many of the properties of electrical charges can be demonstrated with a set of small pith balls covered with metal paint or foil, and suspended by silk threads. If one ball is charged, it will first attract an uncharged ball until the two touch: then the charge spreads to both balls, so that they now repel each other and separate. This principle was used by Abraham Bennet (1750–1799) in his invention of the gold-leaf electroscope (fig. 2), which was the first sensitive instrument that could detect, and to some extent measure, electric charges.

Electrical charges can be found only on the outside surfaces of conductors: inside a hollow conductor there is no sign of a charge or any of its effects. This was first discovered by Henry Cavendish (1731–1810), but the classical demonstration was by Michael Faraday (1791–1867) with a butterfly net (fig. 3).

Charges distribute themselves evenly over the surface of spheres,

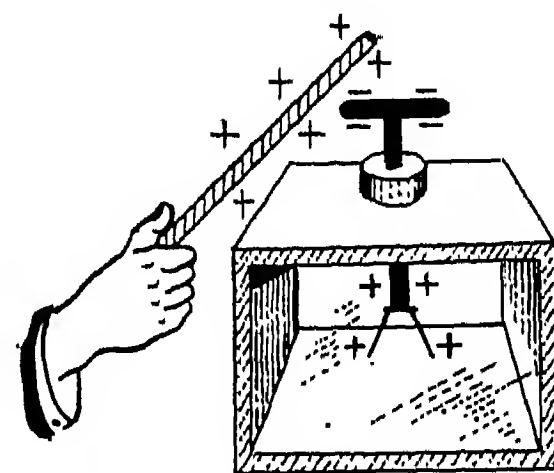


Fig. 2. Gold-leaf electroscope

but tend to concentrate wherever there is an angle or a point. Hence apparatus intended to carry high charges is made with wide smooth

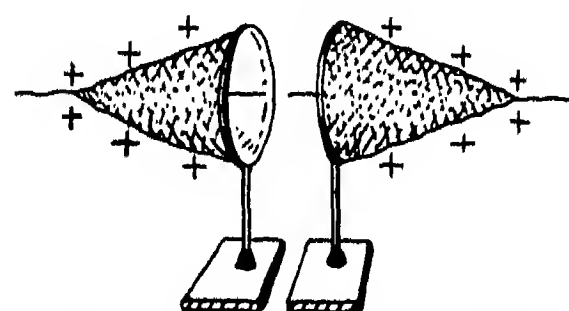


Fig. 3. Butterfly-net experiment

surfaces and large round knobs, avoiding all sharp curves and points, from which the electricity would tend to escape (see Discharge).

The earliest machines for producing electrical charges consisted of arrangements of plates, spheres, or cylinders of glass, sulphur, etc., which could be rapidly rotated in contact with the hand or with built-in rubbers. An example was the machine (fig. 4) designed by Joseph Priestley (1733-1804). Soon after 1770, Alessandro Volta (1745-1827) invented a simple device called an electrophorus (*q.v.*) for obtaining a number of charges by induction from a single charge of frictional electricity produced by rubbing. This was followed by a series of influence machines which could add together the small charges to produce large concentrations of electricity. The most efficient was the Wimshurst Machine (*q.v.*).

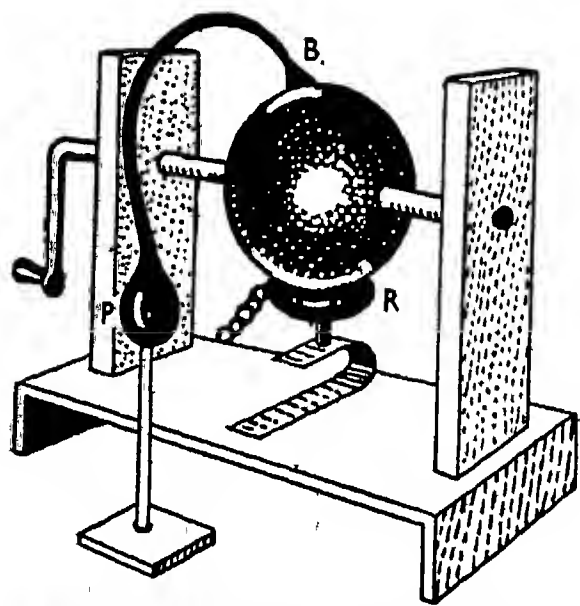


Fig. 4. Joseph Priestley's electrical machine. The globe rotates against the cushion R which is earthed by a chain. The charge is collected by the brush B, which is attached to the prime conductor P.

Another early discovery was the effect of separating two conductors by a thin layer of insulation and earthing one of them: the other could then hold a much larger charge than when isolated. The arrangement became known as a condenser, and later as a capacitor (*q.v.*); but the first form it took was that of the Leyden Jar (*q.v.*).

From a charged Leyden jar sparks of considerable size could be drawn. Their resemblance to miniature flashes of lightning was quickly appreciated. In 1752 the French botanist and physicist T. F. Dalibard (1720-1784), on a suggestion of Franklin's, erected a 40-foot iron rod which produced sparks at the lower end when thunder clouds passed. A few weeks later Franklin himself obtained similar results in America

by flying a kite with a wet string. This led naturally to the invention of the lightning conductor for the protection of tall structures in thunder storms (see Lightning).

The study of fixed electric charges is called electrostatics. It played an important part in the original formulation of electrical theory; but by the end of the 19th century it had come to be looked on as mainly of academic or historical interest. It later had practical importance in a number of fields. Electrostatic attraction is used in air conditioning to lay dust, extract smoke, etc., and in the method of dry photography called xerography. Frictional electricity can make paper in high speed printing machines and fine threads in textile factories difficult to handle. The cure is often effected by using radio-active isotopes to make the atmosphere conducting. In hospitals, and especially in operating theatres, rubber sheets can easily become highly charged, and with volatile anaesthetics in use sparks may lead to dangerous explosions: this risk is minimised by using conductive rubber instead of the ordinary natural or synthetic kinds. There is also a need for strong electrical fields in nuclear research, which was first met by the invention of the voltage multiplier and the van de Graaff machine. A voltage multiplier induces increased potential by mechanically reducing the capacitance of a charged capacitor by making it charge another capacitor.

ELECTRIC CURRENTS. Towards the end of the 18th century a theory arose that the nerves and muscles of animals in some way generated electricity. While investigating this theory Luigi Galvani (1737-98) hung up some skinned frogs' legs on copper hooks slung from an iron stand. He noticed that whenever the legs themselves touched the iron, they twitched. He took this for an example of "animal electricity." It was his friend Count Alessandro Volta who found the proper explanation, attributing the separation of electrical charges which occurred not to the action of nerves and muscles but to the contact between dissimilar metals. On the basis of this theory he devised an arrangement of about 100 zinc and copper disks separated in pairs by pads of cloth soaked in

brine. This "Voltaic pile" (fig. 5) gave a perceptible shock to anyone touching both ends. It was the first device for producing a continuous electric current, as distinct from the momentary currents which served to discharge electrostatic machines or Leyden jars. A comparable arrangement of copper and zinc plates plunged into vessels of brine or acid, which Volta called a "crown of cups" (fig. 6), gave even better results.

A single cup in Volta's "crown" is the simplest example of what is now called a primary electric cell. It consists of one copper and one zinc rod dipping into a vessel of (say) hydrochloric acid. The rods must not touch in the acid, but when they are connected outside by a metal

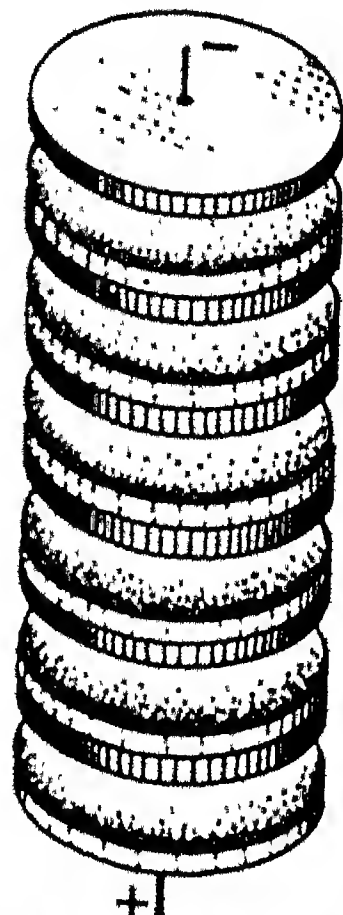


Fig. 5. Volta's pile

wire an electric current flows continuously through the wire. While the current flows, the zinc rod gradually dissolves in the acid, and the energy which drives the current is derived from the decrease in chemical energy represented by the wasting away of the zinc.

In agreement with Franklin's decision about positive and negative electricity, the current is conventionally spoken of as flowing outside the cell from the copper to the zinc, then back again inside the

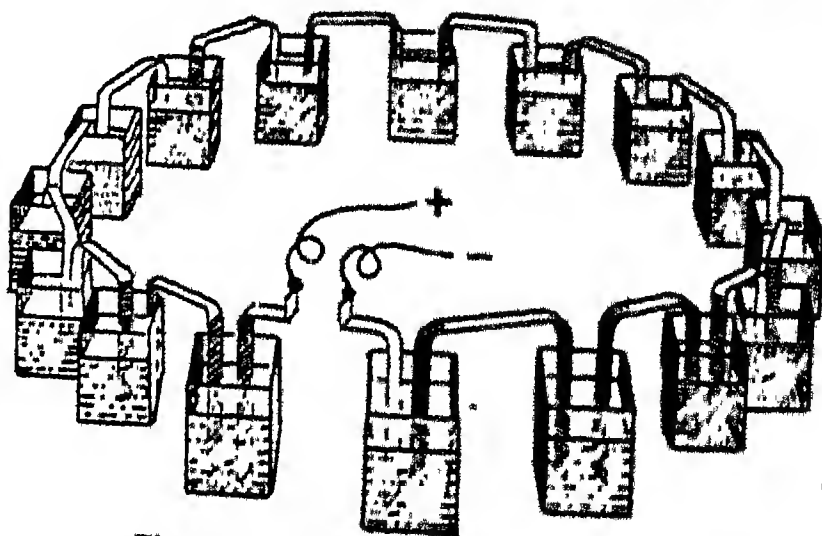


Fig. 6. Volta's "crown of cups"

cell from the zinc to the copper. The copper, or positive terminal, is said to be at a higher potential than the zinc, or negative terminal, and this potential difference (p.d.) causes the current to flow, just as a difference in level of two reservoirs will cause a flow of water through

a pipe connecting them. On this analogy (which is useful but not exact) the pressure derived from the extra height or head of water in one reservoir corresponds to the potential difference or voltage in an electric circuit; the rate at which the water flows through the pipe corresponds to the current or amperage, and the narrowness of the pipe to the electrical resistance in the circuit. A primary cell or a battery can be thought of as the equivalent of a pump maintaining the difference in level between the two reservoirs.

If, in an actual water system, such as that shown diagrammatically in fig. 7, the circulation is stopped by closing the tap T, the level of water in the upper reservoir would rise to a height which would depend solely on the strength of the pump. This height above the lower reservoir would then measure the energy available to drive water round the whole circuit. The

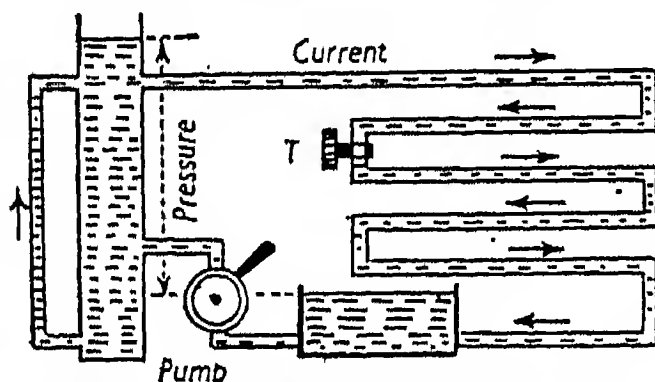


Fig. 7. Analogy between water flow and electrical circuit (see text)

corresponding electrical quantity is called the electromotive force (e.m.f.) of the cell, and is equal to the p.d. between the terminals of the battery when the circuit is broken and no current flows. If now the tap is opened so that water begins to circulate, the level in the upper reservoir will fall slightly; and the difference in level between the two reservoirs will now correspond to the p.d. between the terminals of the cell or battery when a current is flowing; this is always less than the full e.m.f. of the cell by the amount necessary to drive the current back through the cell itself.

During the 19th century a number of improvements on Volta's original cell were devised, of which the chief was the cell invented by Georges Leclanché (1839-1882) which was named after him and is still used in dry batteries of all sorts. The Leclanché cell substitutes a carbon rod for copper as the positive terminal, and a paste saturated with sal ammoniac and zinc chloride for hydrochloric acid. (See Cell, Electric.) When the sal ammoniac is exhausted the cell ceases to work and is usually thrown away.

Secondary cells, or accumulators, differ in being reversible; that is to say, the passage of a

current from an external source through them produces chemical change, which in turn will drive a current in the opposite direction when the original source is removed. The usual form has cellular lead plates packed with dilute sulphuric acid. When put on charge the sulphate at both electrodes is broken up, leaving pure lead at the cathode and lead peroxide at the anode, and increasing the amount of sulphuric acid at both terminals. When the current is drawn off (in the opposite direction) these changes are reversed, and the extent to which the accumulator has been discharged can be estimated from the strength, and hence the density, of the solution as measured by a hydrometer.

Accumulators provide the only practical (though still rather clumsy) means of "storing" electrical energy in a portable form.

Within a year of Volta's dis-

covery of the primary cell it was found that an electric current could in certain circumstances break up a chemical compound into its constituent parts. In 1800 William Nicholson (1753-1815) and Anthony Carlisle (1768-1840) separated water into hydrogen and oxygen in this way. Seven years later Davy used the new method to break up caustic soda and caustic potash, and so isolate for the first time the elements sodium and potassium. The process, called electrolysis (*q.v.*), is now used on a large scale not only for the extraction of such metals as aluminium and magnesium from their ores, and the refining of gold, copper, nickel, etc., but also in the commercial production of oxygen, hydrogen, chlorine, fluorine, caustic soda, heavy water, and many other substances.

The result of electrolysis is not always confined to separating the electrolyte into elements or groups of elements. Often the substances so formed will re-combine with the materials of the electrodes or with the water in which the electrolyte is dissolved. A typical result of such a process is for the metal of one terminal to be progressively dissolved away while a thin layer of the same metal is deposited on the other terminal. This is the basis of electroplating, whereby

the articles to be plated are suspended in a tank containing a suitable electrolyte, so that they form the cathode, with plates of the metal to be deposited forming the anodes.

In the early 19th century many experimenters observed that the wires carrying electric current tended to get hot. In 1827 G. S. Ohm in Germany suggested the idea that conductors offer a resistance to the passage of electricity comparable with the resistance offered by friction to mechanical motion. Thin wires or other conductors offer more resistance, and if the current is large enough they can become red hot like the elements in electric cookers and heaters, or white hot like the filaments in electric light bulbs. Alternatively a metal with a very low melting point will melt if the current rises above a certain strength and so automatically break the circuit. This is the basis of the electric fuse. As early as 1840 James Joule (1818-1889) was measuring the relation between heat and current in electric circuits, but the familiar application of the principle to lighting had to await invention of the carbon-filament lamp in 1860 by Joseph Swan (1828-1914).

The best conductor of electricity is silver, with copper a close second. Because of its comparative cheapness and good conductivity copper is generally used in electrical wiring and machinery. Aluminium is relatively a poorer conductor but is used for long-distance cables because of its lightness. Glass, porcelain, rubber, silk, oil (hydrocarbons), and silicones are poor conductors and, consequently, good insulators.

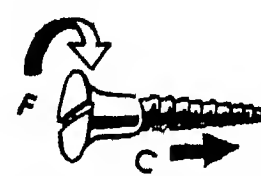


Fig. 8. Screw rule: F, field; C, current

At very low temperatures (within a degree or two of absolute zero) certain metals lose their electrical resistivity entirely so that a current once induced in them will continue almost indefinitely. This phenomenon is called superconduction.

In 1819 H. C. Oersted (1777-1851), professor of physics in Copenhagen, discovered almost by accident that a wire carrying an electric current could make a magnetic needle turn out of its north-and-south position. The effect is such that it tends to make the north-seeking end or pole of the magnet rotate round the wire in the direction indicated by a right-handed screw driven along the path of the current (fig. 8).

A south-seeking pole tends to rotate in the opposite direction.

The force exerted by a moderate current in a single straight wire is comparatively small; but if the wire is bent into a long coil or solenoid (fig. 9) the forces produced by all the various parts reinforce themselves down the centre. The coil then acts as the equivalent of a bar magnet; and with a sufficient number of turns and a large enough current the strength may be much greater than any permanent magnet of comparable size.

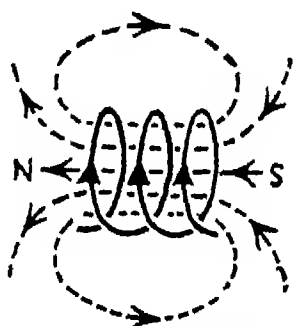


Fig. 9. Magnetic field produced by a solenoid

Twelve years after Oersted's discovery that the movement of electricity in a circuit gives rise to magnetic effects, Faraday discovered that the movement of a magnet near an electric circuit gives rise to an electric current. He thrust a bar magnet into an empty solenoid, then pulled it out again: when the magnet moved a current flowed through the coil; but when the magnet was at rest, either inside or outside the coil, no current flowed at all. The phenomenon is called electro-magnetic induction.

If instead of a magnet and a coil two solenoids are arranged one inside the other, the inside one will become the equivalent of a magnet when a current from a cell or battery is passed through it. Starting or stopping the current in this primary coil is then the equivalent of rapidly pushing in or pulling out a bar magnet. Thus a repeated make-and-break in the primary circuit will produce in the secondary circuit an induced current which flows alternately in one direction and then the other. Applications of this principle include the shocking or sparking coil called a Ruhmkorff coil, which was a favourite attraction on Victorian seaside piers, and provided the ignition system for the earliest motor cars. Another application is the transformer, used to change the voltage of power supplies. It consists of a laminated iron-core provided with a primary winding receiving the supply and a secondary winding of a different number of turns in which an e.m.f. is induced having a correspondingly lower or higher voltage.

Starting or stopping the flow of electricity in a coil tends to

induce currents not only in other coils (mutual induction), but also in the primary coil itself (self induction). In effect, each loop (or smaller element) of the coil exercises an effect of induction on the neighbouring loops (or elements) of the same coil. The basic rule of all electro-magnetic induction is that the induced magnetism or the induced current will always be in the direction which will tend to oppose the change in current or in magnetic field producing it. Thus when the current is switched on in a coil, self-induced currents tend to oppose the change and the current, instead of starting suddenly, has to build up gradually to its maximum. Conversely, when the current is switched off there is a sudden extra surge of induced current opposing the cessation, which if strong enough may jump the gap in the switch in the form of a spark. In power

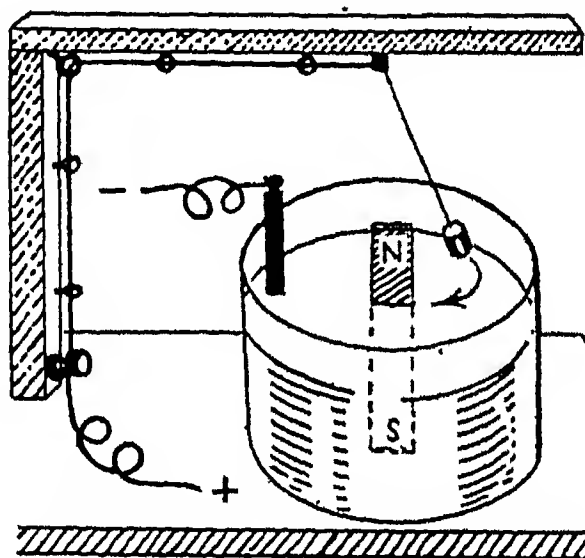


Fig. 10. Faraday's demonstration of electro-magnetic rotation

houses, and other places where large currents are dealt with, special devices called contact breakers are provided to minimise the danger of sparking-over when circuits are suddenly interrupted.

In 1821 Faraday succeeded in producing continuous rotary motion by the interaction of a magnet and an electric current. The magnet was fixed upright in mercury; a wire had its lower end floated by cork so as to touch the surface of the mercury, its upper end lodged in an inverted silver cup which held a small drop of mercury to ensure at the same time free movement and a good electrical connexion. The passage of a current through the wire made it rotate round the magnet (fig. 10). Shortly afterwards Peter Barlow (1776-1862) devised a star-shaped wheel with points dipping into a mercury trough between the poles of a horseshoe magnet: the wheel rotated when a current was applied between the axle and the mercury

(fig. 11). This was the ancestor of the electric motor in which the output of mechanical power is made much greater by substituting an electro-magnet for the permanent magnet, and a special arrangement of copper conductors round a soft iron core, called an

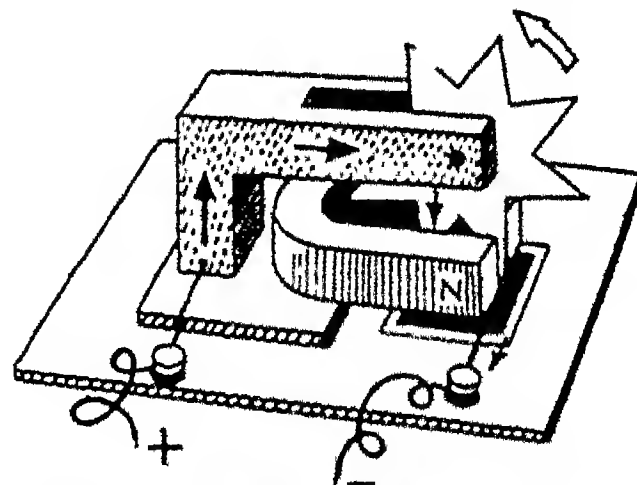


Fig. 11. Barlow's wheel. Black arrows, direction of current; white arrow, rotation of wheel

armature, for the single straight path of the current down the disk.

An electric current applied to such a motor causes the armature to rotate. Conversely, if the armature is driven round by an external force a current will be induced in the circuit. This is the principle of the dynamo and all electric generators. The simplest form of armature consists of a single loop of wire rotating between magnetic poles (fig. 12). If the current is drawn off by means of two slip-rings, as in fig. 12, it will be found to flow first in one direction, then in the other, changing with each half-rotation of the loop. The result is alternating current (A.C.) as distinct from direct current (D.C.), which flows continuously in the same direction. Direct current can be obtained from a dynamo

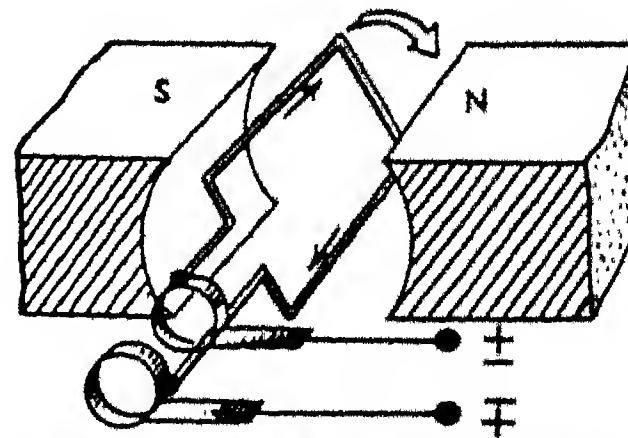


Fig. 12. Simple armature. White arrow, armature rotation; black arrows, current direction

by using a commutator, or when necessary A.C. can be reduced to D.C. by devices called rectifiers.

Alternating Current. Since the heating effect of a current is unaltered by the direction in which it flows, and since motors can be as easily designed for alternating as for direct current, A.C. is just as effective as D.C. for most domestic and industrial uses. Its

great advantage is that the voltage can be stepped up or down at any time by simple transformers that have no moving parts. This is of particular value in large-scale supply systems, since power can be carried long distances with much less loss at high voltages, and consumed with much less danger at low voltages. Moreover, current is more easily produced at high voltages by alternators than by (D.C.) dynamos.

In simple A.C. the voltage and current build up gradually to a peak in one direction, fall off to zero, build up to a peak in the opposite direction, then fall to

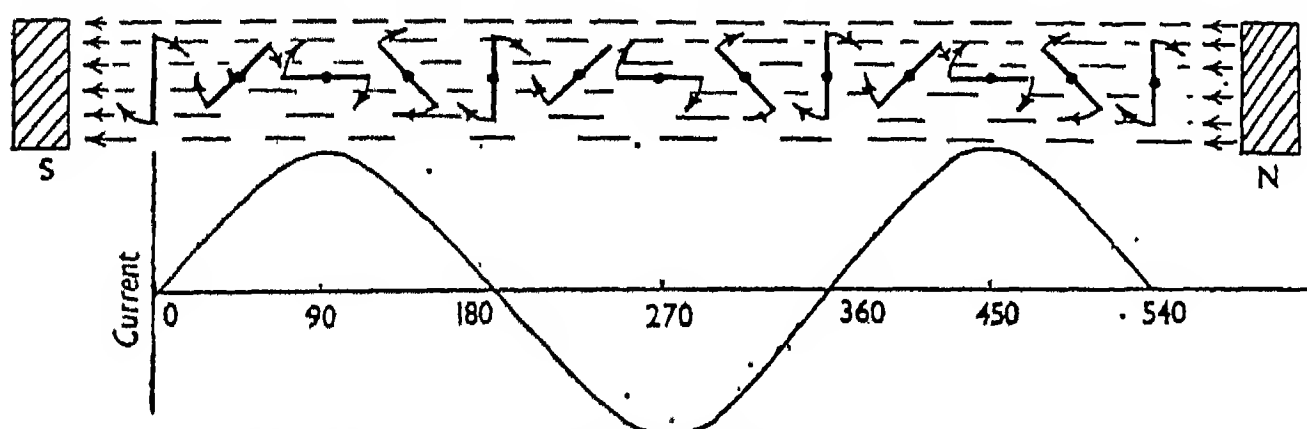


Fig. 13. Graph of alternating current produced by rotation of single-wire loop in magnetic field as in Fig. 12

zero again, this whole sequence constituting one cycle (fig. 13). The number of cycles per second is the frequency. The standard British supply is at 50 c.p.s.

When alternating current passes through a coil the effect of self-induction is to oppose and so delay each reversal in the direction of the current. In consequence the changes in the direction of the current tend to lag behind the changes in direction of the voltage producing it. A coil introduced into a circuit with the express object of producing a phase lag of this sort is called a choke or choke coil.

The opposite effect, with the phase of the current running ahead of the voltage, is produced by including capacitors in the circuit. At first it seems surprising that any current should pass through a capacitor, which interposes a complete insulating layer between the plates attached to its two terminals. One way of illustrating what happens is to liken a capacitor in an electric circuit to a rubber membrane stretched across a water circuit (fig. 14). There can be no continuous flow of water in one direction, but the water can still oscillate to and fro, stretching the membrane first in one direction then in the other. Alternatively the electricity can be imagined as flowing into one plate of the capacitor and charging

it heavily in one direction; then draining out of that plate and flowing into the other one with the reversal of the current. In these circumstances the charged capacitor tends to discharge itself before the voltage has quite dropped to zero, so that the changes in direction of the current tend to run ahead of the changes in direction of the voltage. Thus the phase change brought about by a choke can be cancelled out by the introduction of a capacitor of suitable size, and vice versa.

Both choke and capacitor however tend to reduce the strength of the current which will be produced by a given voltage. This

effect is additional to the ordinary resistance of the circuit. It is called reactance; conductive reactance in the choke, capacitive reactance in the capacitor. The combined effect of resistance and reactance in an alternating circuit is called impedance.

Field Theory and Electro-magnetic Waves. Michael Faraday was the first major scientist who really studied electricity and suggested its practical applications. He visualised the forces exerted by magnetised and electrostatically charged bodies as though they were somehow spread out and diffused through the whole surrounding region, rather than merely concentrated in the bodies themselves. Such a region he called a field of force, and he proceeded to map the distribution of electric or magnetic forces in it by imaginary lines which he called lines of force.

Electrostatic lines of force can be defined as lines which throughout their length assume the direc-

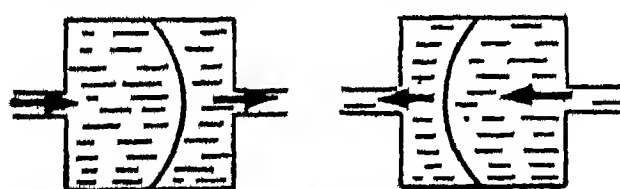


Fig. 14. Alternating water flow transmitted through rubber membrane

tion in which a free positive charge would move under the influence of the electrostatic field. The

patterns they assume can be made visible by scattering powdered gypsum on horizontal sheets and tapping the sheets till the gypsum fragments aline themselves in the electric field (fig. 15). Similarly magnetic lines of force chart the direction in which a small isolated north-seeking pole would move under the influence of the magnetic field, and their patterns can be made visible by the use of iron filings instead of gypsum. (For examples see Magnetism.)

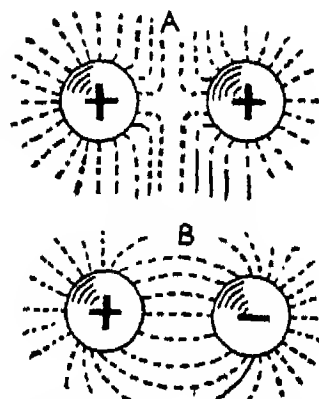


Fig. 15. Electrostatic lines of force between charged spheres: (a) unlike charges; (b) like charges

The arrangement of electric lines of force is always what one would expect if they possessed three important properties:

1. Any given line of force starts on a positively charged surface and ends on a negatively charged surface;
2. It resembles a stretched elastic, tending to contract to as short a length as possible;
3. It repels, and is repelled by, all neighbouring lines of force in a direction perpendicular to the lines themselves.

Rules 2 and 3 apply equally to magnetic lines of force. Rule 1 applies for permanent magnets, with north- and south-seeking

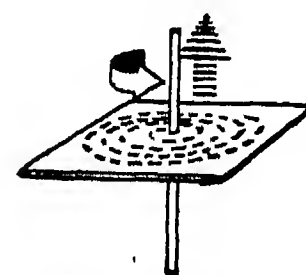


Fig. 16. Magnetic lines of force circling wire carrying current

poles substituted for the charged surfaces; but lines of force resulting from electric currents frequently take the form of closed curves, as in fig. 16.

Faraday was able to introduce some precision into his picture by stipulating that one line of force should emerge for each unit of electric charge on a body or for each unit of pole strength in a magnetic pole. The strength of a field was then represented by the closeness with which the lines of force were crowded together. The tendency for any electric circuit carrying a current is to move relatively to a magnetic field in such a way that as many lines of force as possible shall pass through the area embraced by the circuit. The current induced in an electric circuit depends on the rate of change in the number of lines of force passing through it. From this it became possible to compute the

behaviour of generators and motors from the geometrical properties of their design.

It is of the essence of Faraday's field theory that what affects the state of affairs at any one point is always the state of affairs at immediately neighbouring points, so that the electric or magnetic forces concerned are represented as spread out or diffused continuously through the field; and this is just as true when the field occurs in empty space as when it occurs in a physical medium. This odd idea of a change in the state of nothing is now generally accepted by physicists as part of the essentially inexplicable nature of the physical world: during the 19th century it was ingeniously avoided by the assumption of a mysterious all-pervading medium called ether (*q.v.*).

Maxwell's Wave Motion

Between 1856 and 1864 J. Clerk Maxwell (1831–1879) translated Faraday's conceptions of electric and magnetic fields into mathematical terms, and in the process arrived at a remarkable prediction. Since a change in a magnetic field produces an electric field in the neighbourhood, and a change in an electric field produces a magnetic field, he argued that the process must be self-perpetuating; so that an interacting magnetic and electric disturbance, once set up, should propagate itself through space as a form of wave motion, like ripples on a pond or sound in air. Maxwell even calculated the speed at which such an electro-magnetic wave would travel (3×10^{10} cm. per sec. approx.). Since this was in fact the speed of light, he concluded that light itself might be made up of electro-magnetic waves.

In 1874 Gustav Hertz (1887–1950) in Germany produced the rapidly alternating current required by discharging a capacitor suddenly through a choke, and detected the resultant radio, or as they were originally and popularly called, wireless, waves by means of a specially arranged circuit in a neighbouring room. This was the first demonstration of what is now called radio (*q.v.*).

Thermo-electricity. In 1829 T. J. Seebeck (1770–1831) discovered that in a circuit containing two different kinds of metal, if one junction between the two metals was kept consistently hotter (or colder) than the other, a continuous electric current would flow round the circuit. The

current is not large enough for this to be developed into a useful source of electric power; but devices based on the Seebeck effect, *e.g.* thermocouples and thermopiles, are frequently used as thermometers for measuring very low and very high temperatures and radiant heat.

The Peltier effect, whereby the passage of a current through a circuit made up of different metals leads to a difference of temperature at the various junctions; and the Thomson effect, whereby a rod of a single metal will develop a potential difference between parts maintained at different temperatures, are of purely academic interest.

Discharges in Gases. Dry air (or indeed any permanent gas) is a remarkably good insulator. Only when a high potential is applied across a limited distance does the insulation break down and allow a spark to pass. By beginning with two conductors in contact and gradually separating them, it is possible to maintain the equivalent of a continuous spark across a narrow gap. Such an arrangement is called an electric arc. It is self-luminous, and extremely hot; and if it is struck between carbon terminals the tips of these become white hot, thus providing an intense and fairly concentrated source of light. Arc lamps were the first form of electric lighting, and continued to be used in searchlights and projectors long after incandescent lamps had replaced them for other uses.

Sparkings and electric arcs occur at atmospheric pressures. If the pressure is increased, the voltage required to break it down becomes greater. Machines for producing high voltages (*e.g.* the van de Graaff machine) are sometimes enclosed in chambers filled with inert gases at high pressure to increase the strength of the insulation.

Geissler Tubes

Low-pressure electricity can pass through gases much more easily. The conditions were investigated by Heinrich Geissler (1814–79) in the 1850s. He used long glass tubes with platinum wires sealed through each end. As platinum has a coefficient of expansion very close to that of glass, a platinum wire can be sealed through molten glass without either leaving gaps or cracking the glass as it cools. When a Geissler tube is evacuated to a pressure of a few centimetres

of mercury, the initial fluctuating spark gradually settles down into a steady streamer. As the pressure is further lowered, this broadens till it fills the whole tube with light. The colour of the light varies with the kind of gas: red for neon, blue for helium, purple for argon, etc. and tubes of this kind, called collectively neon tubes, are widely used for advertisements.

If the pressure is still further lowered to 0.1 mm. Hg or less, a dark space near the negative terminal or cathode begins to grow, till eventually it fills the whole tube. At this stage the glass itself begins to shine with a greenish fluorescence. For strip lighting the walls of the tube are coated with special fluorescent materials so chosen that the resultant light is as near to daylight as possible.

In 1879 William Crookes (1832–1919) hung a Maltese cross in a specially-shaped discharge tube, and found that it cast a clear-cut shadow on the fluorescent glass (Fig. 17), showing that the

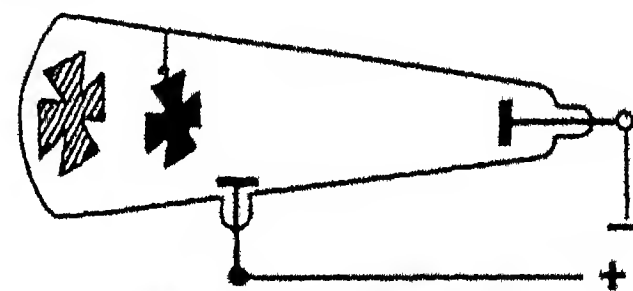


Fig. 17. Crookes Tube

fluorescence must be caused by rays sent out in straight lines from the negative terminal or cathode. These cathode rays were then found to be bent out of their straight paths by magnetic fields; and this suggested that they must be made up of fast-moving particles carrying electrical charges, rather than electro-magnetic waves which are not deflected by magnetic fields. In 1897 J. J. Thomson (1856–1940) worked out the ratio of charge to mass which would be necessary to give the particles their observed deflection, and guessed from this that the particles in cathode rays must be almost certainly very much smaller than the smallest known atom, namely the hydrogen atom. They were given the name electron by the Irish physicist G. J. Stoney (1826–1911).

Electronic Theory. It was on the basis of Thompson's work, combined with a long series of detailed investigations into radioactivity that Ernest (later Lord) Rutherford (1871–1937) in 1911 put forward the theory that the atoms of which all matter was made were not hard individual

lumps like billiard balls, but composite structures consisting of a tiny nucleus positively charged, surrounded by negatively charged electrons. In each normal atom there were just a sufficient number of electrons outside the nucleus to balance exactly the charge on the nucleus, leaving the atom as a whole electrically neutral.

This conception of the atom was the basis of the electronic theory of electricity, which postulates that a positive charge results from a deficit of electrons, and a negative charge from an excess of electrons.

When certain substances (called electrolytes) are dissolved, some of their molecules spontaneously break up (dissociate) into two parts called ions, one of which carries more, the other less, than its proper share of electrons. Thus some of the ions are positively, some negatively, charged; and when a potential is applied across the solution, the negative ions (anions) drift towards the positive electrode (anode), to which they transfer their excess electrons on arrival; while the positive ions (cations) drift towards the negative electrode (cathode), from which they make good their deficit of electrons on arrival (fig. 18). The result is a continuous transfer of electrons from cathode to anode, equivalent to a conventional current through the liquid from anode to cathode. This theory also explains the separation of different chemical constituents of the electrolyte at the two electrodes.

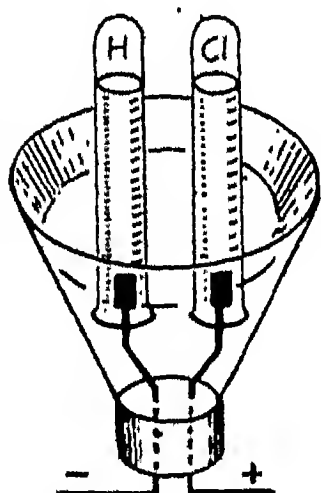


Fig. 18. Electrolysis of hydrochloric acid. Positive H ions drift towards the negative electrode; negative Cl ions towards the positive electrode

The passage of electricity through gases also depends on ionisation, but the mechanism is much more complicated. Electrons become detached from atoms in a gas by the effect of ultra-violet light, radio-activity, and cosmic rays. In an electric field the free electrons move rapidly towards the anode. On the way they may collide with neutral atoms, and, if they are moving fast enough, knock fresh electrons off them, so that the supply of free electrons becomes cumulatively greater. The speed they achieve depends on the

strength of the electric field between the electrodes and on the distance travelled between collisions. This last depends on the pressure of the gas: if the pressure is too high the atoms of gas are too close together for moving electrons to accelerate sufficiently between collisions to ionise fresh atoms; if the pressure is too low, the majority of electrons may reach the anode before they encounter any neutral atoms and the current dies down from lack of a continuing supply of electrons to carry it. At intermediate pressures, varying conditions produce the series of effects observed in Geissler tubes.

The conduction of electricity in solids is usually much simpler: and most phenomena can be explained by regarding it as a continuous drift of electrons through the open structure of the crystal lattice (see under Crystallography). Conductors are those solids (mostly metals) in which one or more electrons are set free, by the arrangement of atoms in the crystal, to move with comparatively little impediment in any direction in which a potential is applied. But as the electrons carry negative charges, their actual movement, from negative to positive terminal, is in the opposite direction to that in which the conventional current is held to flow.

ELECTRONICS. As early as 1884, Thomas Edison (1847-1931) noted that if he fused an extra terminal into a filament lamp, a current would flow through the vacuum inside the bulb when the new terminal was connected to the positive end of the filament, but not when it was connected to the negative lead (fig. 19). Since the effect occurs in a high vacuum, sufficient electrons to carry the current cannot be produced by the ionisation of residual gas as in discharge tubes. Instead they are derived directly from the hot filament. It is known that a red-

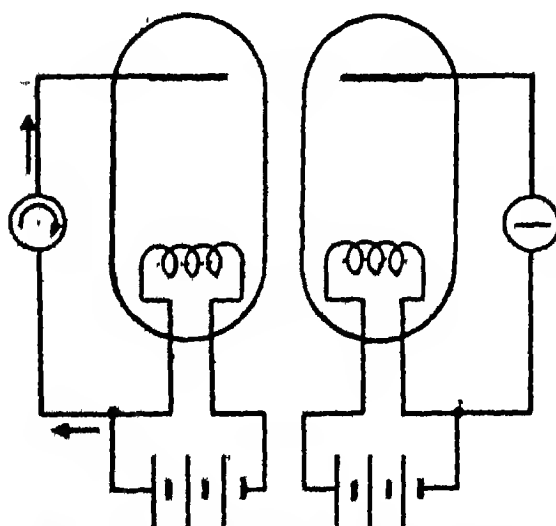


Fig. 19. Edison's lamp filament experiment (see text)

hot conductor sprays out electrons from its surface spontaneously. In the absence of an electric field these fall back in due course and are re-absorbed; but if another conductor near by is kept at a positive potential, it will attract the free electrons and absorb them. When the gap between the conductors is evacuated, the electrons fly across in straight lines at high speed, and this stream of electrons is in all respects the equivalent of an electric current.

Two things about it are, however, important. First, the electrons can cross in one direction only—from the hot to the cold terminal. If the potential difference is reversed, no current flows, for no electrons are available at the cold terminal to carry it. Consequently an arrangement like that shown in fig. 20 acts like a

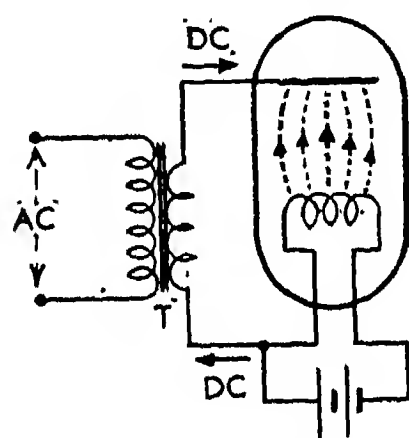


Fig. 20. Diode acting as rectifier. A.C. is fed in through the transformer T. The conventional direction of the resultant D.C. is shown by arrows, D.C. Dotted arrows inside valve show direction of electron movement

valve, letting electricity pass one way but not the other. This form of thermionic valve (depending on negative ions produced by heat) was invented in 1900 by J. A. Fleming (1849-1945) and is called a diode. It provides the most convenient means of converting alternating into direct current.

Secondly, the stream of electrons, being without cohesion and almost without weight, is immediately and very sensitively responsive to any magnetic or electric field which may be applied. For instance, if a metal grid is interposed between the electrodes of a diode, the amount of current which passes through the valve can be minutely controlled by comparatively small and rapid fluctuations in the grid potential. The device, called a triode (fig. 21, p. 2995), can thus be used to reproduce at much greater current strength the very small potential variations which are derived from a microphone or an aerial, and was used for this purpose in 1907 by its American inventor, Lee de

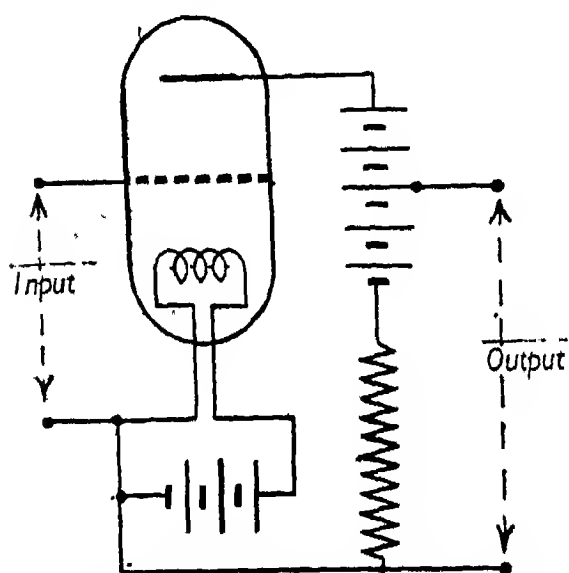


Fig. 21. Triode acting as amplifier

Forest. Greater fidelity can be obtained by using two or three grids as in the tetrode and pentode.

Alternatively a single steady stream of electrons can be made to converge on or diverge from a point or focus by arrangements of coils or charged plates as in the electron microscope or it can be moved to and fro and up and down with high speed and extreme precision by pairs of coils or plates above and below and at either side, as in oscilloscopes and radar and television screens. (For some of the many other applications of these principles see under the article Electronics.)

Photo-electricity. The effect of light on electric phenomena can be of three kinds :

1. Light rays falling on the surface of certain substances (*e.g.* the alkali metals sodium, potassium, rubidium, and caesium) provoke an emission of electrons comparable to that from a red-hot cathode. If a cathode with a photo-emissive surface is substituted for the hot wire in a simple diode, the current transmitted through the vacuum will vary according to the strength of the light falling on the cathode. Thus variations in the brightness of a beam of light can be translated into variations in an electric current. This form of photo-electric cell, called a photo emissive cell, is used for, among other things, reproducing sound from the sound-strip on cinema films.

2. Light falling on certain other substances (*e.g.* selenium or lead sulphide) greatly reduces their electrical resistance. This effect can also be used to translate varying strengths of incident light into variations in electrical current. The response, however, is slower ; and photo-conductive cells are more commonly used for comparatively simple applications, such as turning lights on and off at sunset and dawn, opening doors by infra-red rays, counting objects on delivery belts, etc ; or for

measuring the strength of light or other rays ; *e.g.* in infra-red spectroscopy.

3. Light rays falling on a surface dividing certain substances (*e.g.* copper and cuprous oxide or iron selenide) gives rise to a potential difference between the layers which can be tapped off as a very small electric current. The chief application of this photovoltaic effect is in photographic exposure meters.

Both photoconductive and photovoltaic effects depend on the properties of certain substances which conduct electricity much less easily than ordinary metals but much better than proper insulators. These substances are called semiconductors, and the theory of semiconductivity has been greatly developed since 1945. This work led to the invention of a device called a transistor (*q.v.*) which can do much of the work of thermionic valves while occupying very much less space and being less liable to damage by excessive vibration.

Instruments and Circuits. The simplest instrument for measuring electric current is the galvanometer, first used in 1820 in a primitive form (fig. 22) by Johann

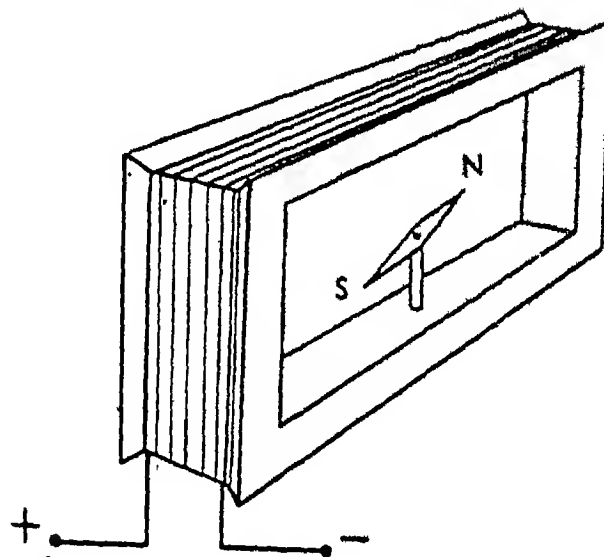


Fig. 22. Schweigger's multiplier, on which is based the galvanometer

Schweigger (1779-1857). It consists of a coil of wire with a magnetic needle at the centre which is deflected by the passage of a current through the coil. Alternatively there may be a large, fixed horseshoe magnet, with the coil carrying the current free to turn between its poles (fig. 23). If the coil consists of a few turns of thick wire, its resistance is small and does not

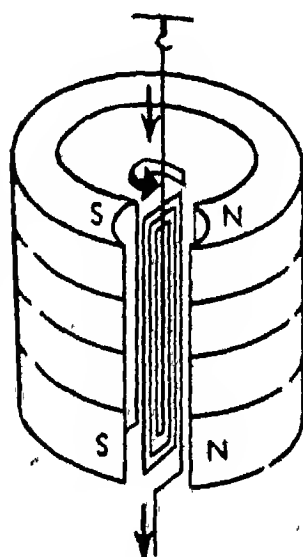
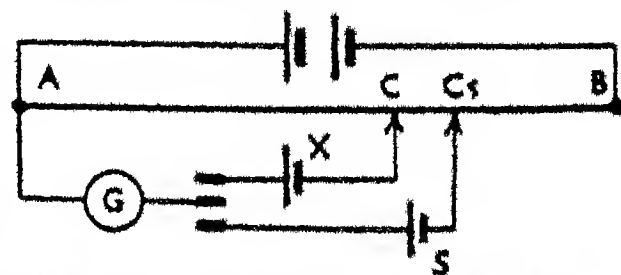


Fig. 23. Moving-coil galvanometer

materially affect the current it is designed to measure. This is the arrangement adopted for the ordinary ammeter. If, however, it consists of many turns of thin wire so that its resistance is relatively high, it allows a minimum of current to flow, and the deflection of the needle provides (to a close approximation) a measure of the potential difference between the terminals to which it is attached. This is the form of wiring used in most commercial voltmeters. Current can also be measured by its heating effect on a wire, as in the hot-wire ammeter, which is particularly useful in the measurement of alternating current ; or by a current balance, in which weights are balanced directly against the forces developed between coils carrying the current.

The gold-leaf electroscope (*q.v.*) can be used within limits for measuring potential difference ; but the most sensitive electrostatic instruments all derive from Kelvin's quadrant electrometer, in which a light metal vane is deflected by a concentration of the electric field at the centre of quadrant-shaped metal boxes. Another method depends on the phenomenon that if a current is flowing through a conducting wire of uniform resistance, the fall in potential between one end of the wire A and any given point X along its length will be proportional to the length of the segment AX. In the device called a potentiometer (fig. 24) a steady e.m.f. is applied to the wire, and a sliding contact C is arranged so that the unknown e.m.f. can be balanced against the p.d. from A to C. The point of balance is found when no current flows through the galvanometer, G. The process is then repeated and a new point of balance, C_s, found with a standard cell such as a Weston cell replacing the unknown e.m.f. The ratio of the

Fig. 24. Potentiometer arranged to compare the e.m.f. of X with the e.m.f. of a standard cell, S. G, sliding contact ; C_s, contact to standard cell ; G, galvanometer. For explanation of its operation see accompanying text

unknown to the standard e.m.f. is then given by AC/AC_s .

This same principle of balancing potentials till no current flows is used also to compare resistances by the device called Wheatstone's

bridge. The metre bridge (fig. 25) uses a sliding contact to a uniform straight wire as in the potentiometer, and at the point of balance the ratio of the unknown resistance X to the standard resistance R is

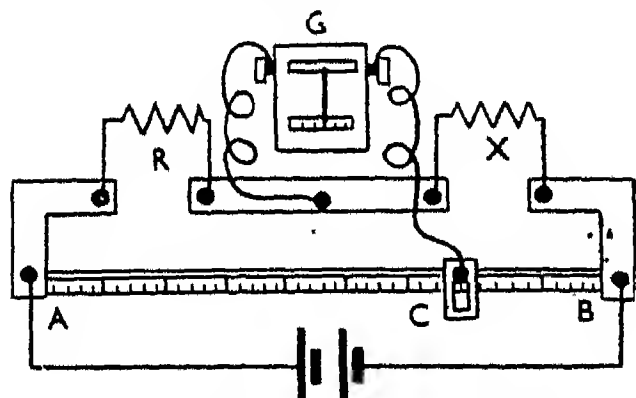


Fig. 25. Wheatstone's metre bridge (see text)

AC/CB. Another type in the form of a net (fig. 26) uses two known resistances P and Q and a variable, resistance R which is also known. A form of the variable standard is the so-called post-office box.

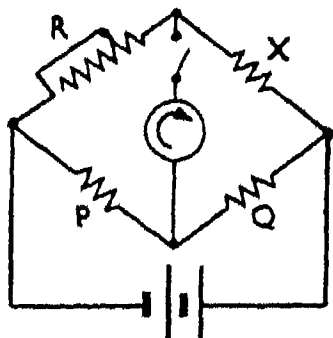


Fig. 26. Wheatstone's bridge in the form of a net (see text)

There are two ways in which two or more pieces of electrical apparatus can be connected in a circuit: in series or in parallel. With apparatus in series (fig. 27), the whole current flows through all the pieces and the removal of any one breaks the circuit; the total resistance R is then equal to the sum of the separate resistances R_1, R_2, R_3 , etc. With apparatus in parallel (Fig. 28), the removal of one piece still leaves a current (and often a larger current) flowing through the rest. For resistances in parallel the total resistance is given by the formula $1/R = 1/R_1 + 1/R_2 + 1/R_3 + \dots$. In practice it is easier to work in conductances: the conductance G is the reciprocal of the resistance R , so that $G = G_1 + G_2 + G_3 + \dots$.

With cells in series the total e.m.f. is the sum of the separate e.m.f.s, and the current they supply correspondingly greater. With cells in parallel the e.m.f. is the same as for the separate cells and

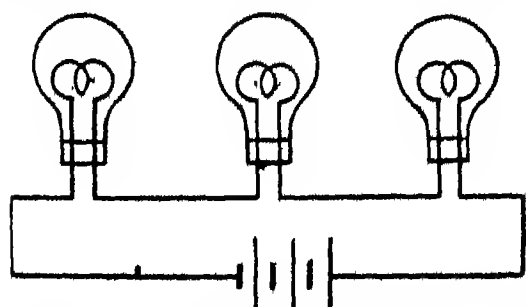


Fig. 27. Lamps and cells in series

the current only very slightly larger (on account of the lowering of the total internal resistance); but the current will flow for a correspondingly longer period before the cells become exhausted.

Units. The first step towards setting up a system of units in which to measure electrical quantities was taken in France in 1785 by Charles Coulomb (1736–1806.) He compared forces between two charged spheres (inventing for the purpose the instrument called a torsion balance (fig. 29)) and found that these, like the force of gravity, varied as the square of the distance apart. Cavendish in England had deduced the same law a decade before from the fact that no electric force could be detected inside a charged hollow sphere, the mathematical argument on which this proof rests having been worked out by Newton for the force of gravity. But

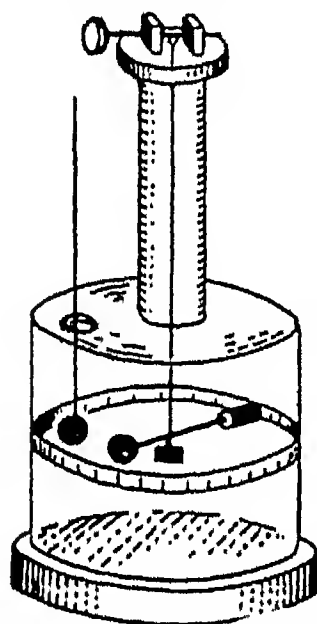


Fig. 29. Coulomb's torsion balance

Cavendish's results were not published till 1789, and the law of inverse squares for electrostatic forces is universally known as Coulomb's law. From this relation it is possible to define an electrostatic unit (e.s.u.) of charge, as the charge which repels an equal and similar charge placed at a distance of 1 cm. in air (or more accurately in a vacuum) with a force of 1 dyne. If q_1 and q_2 are the charges on two bodies in e.s.u., and r the distance apart in cm., the force between them is given by

$$F = q_1 q_2 / r^2,$$

which is the mathematical formulation of Coulomb's law.

An electric field has unit field strength at any point where a small charge q (small enough not to affect the field appreciably by its presence) is acted on by a force of one dyne per unit of charge. Thus the field strength

$$E = F/q.$$

The electrostatic unit of poten-

tial difference is the p.d. between two points such that one erg of work is expended in transporting one e.s.u. of charge from one point to the other. An absolute potential V at any point can similarly be defined in terms of the work done in transporting a unit charge from an infinite distance (or from the earth, taken conventionally as at zero potential) to that point, so that

$$V = W/q = Fd/q.$$

Capacitance, C , is defined in terms of the charge Q required on each plate of a capacitor to produce unit potential difference between the plates; thus

$$C = Q/V.$$

This assumes that the dielectric separating the plates is air (or more strictly a vacuum). For other dielectrics a factor ϵ has to be added, which is specific to the material and is called variously the specific inductive capacity, permittivity, or dielectric constant.

A dielectric is a substance containing few, if any, free electrons, which therefore resists the passage of an electric current and can withstand the application of considerable potential difference without giving way to the electrostatic stress and allowing a discharge to pass. A dielectric can therefore be used as an insulating material for cables, etc., or for the medium separating the electrodes of a capacitor.

Charge, potential, field-strength, and capacitance are all quantities which arise in the study of static electricity, but on the same system it is quite easy to define an electrostatic unit of current as the flow of electricity which transports one e.s.u. of charge past any given point in one second. Historically, however, the first approach to the measurement of currents was made on the basis, not of Coulomb's law, but of Oersted's discovery of electro-magnetic induction. In 1823 A. M. Ampère (1775–1836) established experimentally that a current flowing round a closed circuit (say in the form of a circle) is the equivalent of a very short magnet (or magnetic shell) the moment of which is directly proportional both to the strength of the current and to the area enclosed by the circuit. On this basis an electro-magnetic unit of current can be defined as the current which, flowing round a circuit enclosing 1 sq. cm., would be the equivalent of a magnetic shell of unit magnetic moment. Then if the area of the circuit is A and the current I , the moment of the resulting magnetic shell $M = IA$.

Magnetic moment was originally defined as the product of the

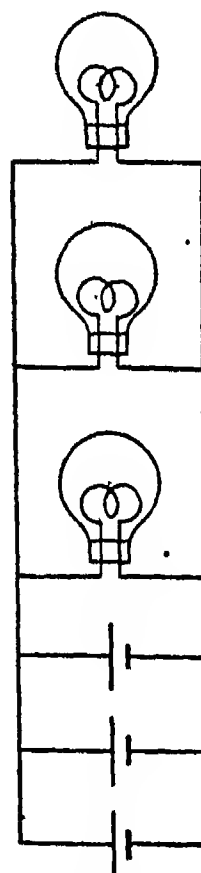


Fig. 28. Lamps and cells in parallel

length of a bar magnet and its pole strength, and a unit pole as a pole which repelled an equal and similar pole 1 cm. away with a force of 1 dyne. Since, however, the conception of isolated magnetic poles on which this rests is purely imaginary (there is no such thing as an isolated magnetic pole in the physical world) most applied mathematicians today prefer to derive the unit of current from the formula for the force F of attraction between two equal coaxial circular circuits at a distance x apart and carrying currents I_1 and I_2 respectively:

$$F = I_1 I_2 a / x$$

From the electromagnetic unit of current can be derived an e.m.u. of quantity (or charge), defined as

Quantity	Sym- bol	Prac. Unit	e.m.u.	e.s.u.
Charge	Q	coulomb	10^{-1}	3×10^9
Current	I	ampere	10^{-1}	3×10^{-9}
Resistance	R	ohm	10^{-9}	$1/(9 \times 10^{11})$
Conductance	G	mho	10^9	9×10^{11}
Potential (electro- motive force)	V	volt	10^8	$1/300$
Capacity	C	farad	10^{-4}	9×10^{11}
Inductance	L	henry	10^9	$1/(9 \times 10^{11})$

(For units of magnetic flux, flux density, magnetic field strength and magnetomotive force see MAGNETISM)

Electricity. Practical electromagnetic and electrostatic units as defined in the M.K.S. system

the quantity of electricity transported past any given point by a current of one e.m.u. in one second. The e.m.u. of potential is then the potential at any point, to which the transport of one e.m.u. of electricity either from the earth or (theoretically) from an infinite distance requires one erg of work.

The measurement of electrical resistance is based on the law, first put forward by Ohm in 1827, which states that the current, I , in a metallic conductor is proportional to the e.m.f. V and inversely proportional to the resistance R :

$$I = V/R.$$

The unit of resistance is therefore the resistance offered by a wire which, when unit p.d. is applied at its extremities, allows unit current to flow through it. The opposite quantity is the conductance, which measures the ease with which a conductor allows a current to pass, and is defined as the reciprocal of the resistance:

$$G = I/R$$

The resistivity of a substance is the resistance of a cube of that substance 1 cm. long, when a potential is applied evenly between opposite faces. It is quoted in ohms

per centimetre cube or ohm cm. The reciprocal, conductivity, is

$$1/k \text{ mho cm}^{-1}$$

Inductance, L , is measured in terms of the induced current produced by a given rate of change in the primary circuit. Thus, if the current in the primary circuit is changing at a rate of 1 e.m.u. per second and an e.m.f. of 1 e.m.u. is produced by this change, then the inductance, L , of the circuit, whether self-inductance or mutual inductance, is 1 e.m.u.

Thus a whole series of electromagnetic units has been built up parallel with, but different from, the electrostatic units. Where the electrostatic system assumes that the permittivity (or number of electrostatic lines of force per sq. cm. in a field of unit field strength) is 1, the electromagnetic system assumes that the corresponding property for magnetic fields (called the permeability) is 1. It is found experimentally that 1 e.m.u. of quantity or charge is equal to 3×10^{10} e.s.u., and 1 e.m.u. of current is equal to 3×10^{10} e.s.u. of current. It is this factor which gave

Clerk Maxwell the clue to the speed of electromagnetic waves.

In practice it is found that electrostatic and electromagnetic units are usually either too large or too small for everyday conveni-

ence. A third set of units has therefore been adopted. They are based on the electromagnetic units, but substitute in their definitions the metre for the centimetre, the kilogram for the gram, and the joule for the erg. The best known of these M.K.S. or practical units are given in the table above.

All these units are defined with complete precision in theory; in practice, however, it is a difficult and complicated task to set up standards against which ordinary measuring instruments can be calibrated. For this reason an international conference in London in 1908 adopted physical definitions for the ohm (the resistance at 0°C of a column of mercury 14.4521 gm. in mass, 106.300 cm. long and of uniform cross section) and the ampere (the steady current which deposits silver from a particular silver nitrate solution at the rate of 0.00111800 gm. per sec.). These standards were found to be not quite accurate, and in 1948 absolute units were re-established as standards (see INTERNATIONAL UNITS; OHM; AMPERE).

In commercial use, electric power is measured in watts (or kilowatts). The watt is a metrical unit of power (mechanical as well as electrical) equal to 1/746 h.p., and the number of watts in a D.C. circuit is the product of the current in amperes and the e.m.f. in volts. The board of trade unit for the sale of domestic electricity is the kilowatt-hour, 1 kW-hr being the energy supplied when 1 kW runs for 1 hr., or 2 kW for ½ hr., etc.

ELECTRIC POWER: GENERATION & USE

David Le Roi

This article gives a brief outline of the history of the industrial and domestic applications of electric power; then follows an account of the methods of generating electric power, including nuclear sources, and its distribution to consumers. For basic principles of electricity see Electricity; Electromagnetic Machines. See also Coal; Fuel; Lighting; Locomotive; Motor; Railway, etc.

Without electric power, industrial and domestic life as known today could not exist. Machinery, transport, industry, and many household activities depend upon constant and easily-available power; and there is no form of power more easily distributed and utilised than electricity. Electric power is simply another way of using the energy of a steam engine, an internal-combustion engine, a water-wheel, a windmill, or an atomic reactor. But electricity is much more convenient and cheap. It would, for example, be uneconomic for every factory and house to instal its own steam

engine or other power source to do all the work that is done by electricity; if steam engines were used there would be the additional cost of bringing coal by road and rail to thousands of separate buildings.

From the beginning of the Industrial Revolution and until the development of cheap electric power, factories and workshops had to be concentrated near coal-producing regions if manufactured goods were to be made with reasonable economy. Every factory had its own steam engine with its attendant boilers, condensers, chimneys, and fuel stores,

together with an appropriate operational staff. Power from the steam engine had to be transmitted to distant parts of a factory by complicated systems of pulleys and belting, which not only made difficult the planning of factory and works layouts, but in themselves wasted a considerable amount of the power from the steam engine.

With the invention of the dynamo, it became possible to use in a few places the power of coal or water wheels to generate electricity and then to send the current produced along wires and cables to millions of users. Factories and workshops could be built wherever electric power is available, which means nearly everywhere in industrialised countries. Every machine installed in a factory can have its own built-in electric motor, designed for the actual machine it serves, and with no power wasted. When an electrically-driven machine is not required for work, the power to it is switched off and there is no fuel wasted in keeping up boiler fires. Moreover, electric power is so convenient and easily obtained that people can have in their homes machines to do many of the simple but laborious tasks that once had to be done by hand.

Electricity is not a source of power, but a convenient method whereby power can be delivered over long distances and distributed to where it is needed by millions of individual users. A dynamo converts the energy of steam, running water, and, occasionally, wind into electrical energy, and this conversion of energy, together with its distribution and reconversion into power for useful work, is one of the most important features of 20th-century civilization.

HISTORY. After Faraday's experiments that resulted in the dynamo, considerable progress was made in methods of generation, but there was little public demand for electric current until the development of the filament lamp between 1875-80. The first public supply of electricity in the U.K. was in 1881, when a dynamo driven by a water-wheel on the bank of the river Wey was used to generate current to light the streets of Godalming in Surrey.

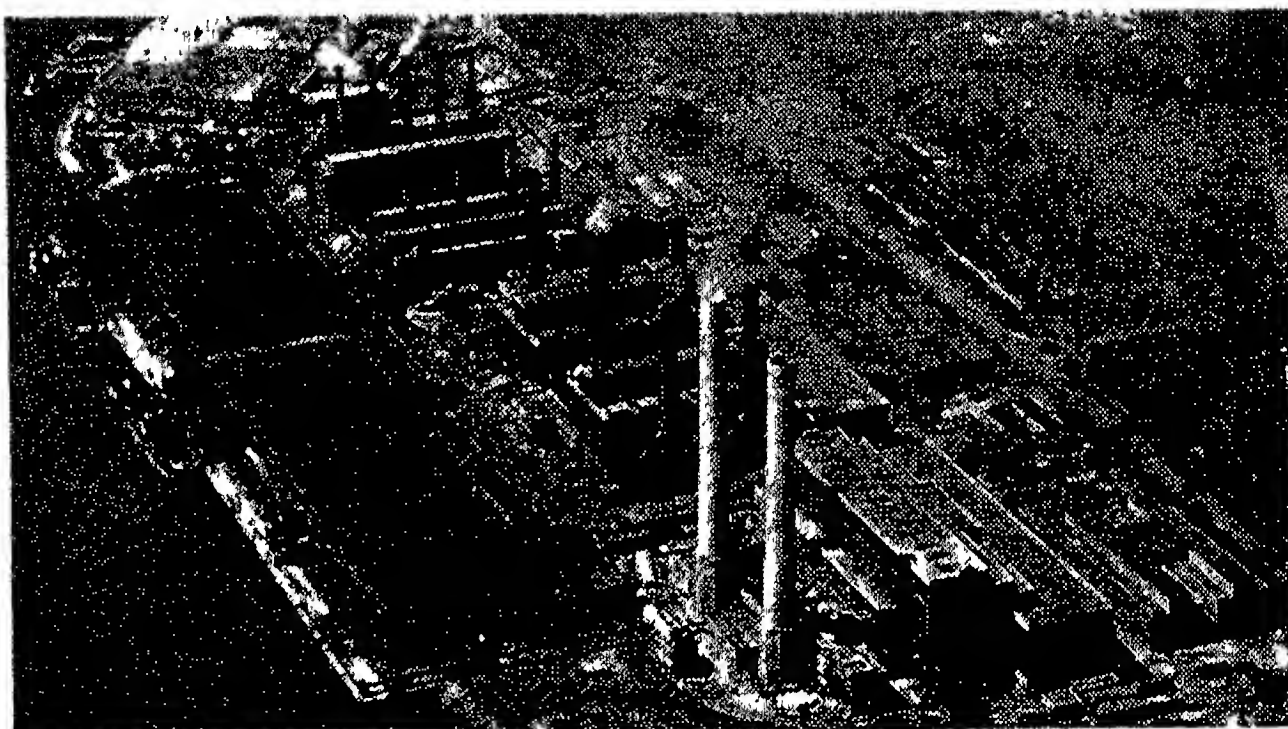
For many years thereafter, public electricity supply was mainly for lighting, as there were few domestic appliances or factory tools designed for electric power. Another factor limiting the use of

electricity was that current could not be sent any great distance by cable. Power stations were in general very small and able to provide current only for lighting houses within a radius of two or three miles. At the beginning of the 20th century, advances in methods of generating and distributing current and the development of the small and compact fractional-horse-power motor very greatly increased the demand for electricity. This resulted in the building of power stations designed to supply areas of several hundred square miles instead of districts of ten square miles or so. Thereafter there was a steady decrease in the number and size of generating stations.

In the second decade of the 20th century there were 438 large and

crop-drying, and even ploughing. Electricity had made it possible for the smallest village to have well-lit streets, and for the most isolated houses to have electric power for refrigerators, vacuum cleaners, washing-machines, irons, and a host of devices that made everyday housework easier.

LEGISLATION. Public electricity supply in the U.K. developed from localised supplies for small areas to a national and integrated organization called the Central Electricity Generating Board. Legislation began with the Electric Lighting Act of 1882, which empowered the board of Trade to grant a licence or provisional order to any local authority, company, or person authorising the generation of electricity and the supply of current for any private or public



Barking power station. On the Roding river, Essex, 8 miles from London, this is the largest of the Central Electricity Generating Board's stations. It has a designed capacity of 500,000 kW

small power stations in the U.K. generating a daily total of some six millions of kilowatts of current. By the 1950s the number of power stations had been reduced to 297, but the amount of current produced every 24 hours had risen to nearly 14,000,000 kW. As 746 watts is equivalent to one horse-power, 14,000,000 kW means that every day industries, homes, and electric transport in the U.K. used an amount of electric current equal to approx. 19,000,000 h.p.

Even more remarkable were the practical applications of electric power made from the beginning of the century onward. By the 1950s thousands of miles of railways had been electrified, and there were few factories that did not use electric tools and machines of some kind, while many collieries, and cement, brick, and steel works operated entirely on electric power. Thousands of farms and dairies used electric power for water-heating, milking, pumping,

purposes within a designated area.

From the beginning it was emphasised that the supply of electric power should be a public service, preferably a municipal one. It was laid down that any local authority which did not in the first instance obtain the right of generating and supplying current in its district had the power to purchase 21 years after establishment in its area any privately-owned electricity undertaking. Legislation was local rather than national in character. This was due in the main to technical considerations. Supplies were at first almost entirely by direct current, so that in general the effective area of distribution seldom extended beyond the area controlled by a local authority.

Development of electricity supply on a commercial basis was liable to be a highly speculative risk for investors, so that it was difficult to raise capital. Moreover, investors hesitated to buy shares in

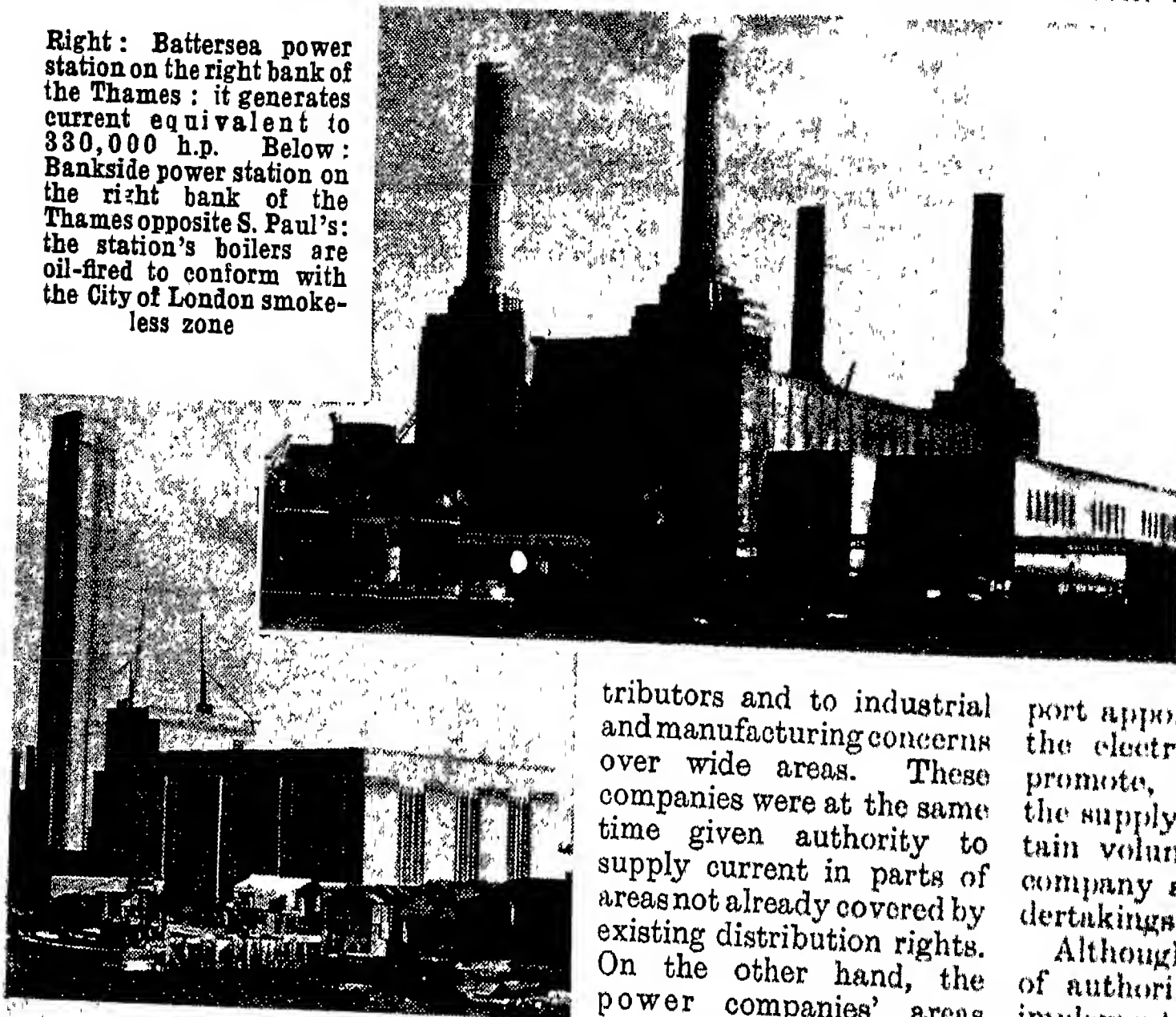
an undertaking liable to compulsory purchase by the local authority. As a result, many districts would have been denied electric power had not the appropriate local authority set up a supply undertaking. Even then, large sections of the community were

To encourage the establishment of electricity undertakings to meet the growing demand for current, special acts of parliament passed in the early years of the 20th century set up various power companies in perpetuity to supply electric power to authorised dis-

was nationalised in 1948, only six such boards were in existence.

Steadily increasing demands for electrical power for munition and other factories in the First Great War exposed the serious weaknesses of the system supplying current in the U.K. Whereupon the first moves were made towards the supply and distribution on a national basis of adequate and accessible power to industry at economic production costs. During 1916-1918 the government set up three committees to consider the problem. One of these, the Electric Power Supply Committee, appointed in 1918, made recommendations which resulted in the Electricity (Supply) Act of 1919, whereby the minister of Trans-

Right: Battersea power station on the right bank of the Thames: it generates current equivalent to 330,000 h.p. Below: Bankside power station on the right bank of the Thames opposite S. Paul's: the station's boilers are oil-fired to conform with the City of London smokeless zone



tributors and to industrial and manufacturing concerns over wide areas. These companies were at the same time given authority to supply current in parts of areas not already covered by existing distribution rights. On the other hand, the power companies' areas generally excluded the supply areas of the larger local authorities generating current, while any established electricity undertaking had the right to veto any company's proposal to increase supply in its local area.

Chiefly because distribution authorities were not obliged to take current supplies in bulk, the new electric supply companies made slow headway, and the policy of encouraging large-scale generation with a comprehensive network of transmission lines and the extending of supply areas suffered accordingly. The Electric Lighting Act of 1909 resulted in some improvement as it gave the power companies and the local authorities equal opportunity to provide bulk supplies. Even more important, the Act of 1909 recognized that the administrative area of a local authority was not always the area which an electricity undertaking could supply efficiently. Although the act authorised the setting up of joint boards of two or more local authorities for the mutual exercise of their electricity supply powers, such cooperation was rare; when the supply of electricity in the U.K.

port appointed a panel of experts, the electricity commissioners, to promote, regulate, and supervise the supply of electricity and to obtain voluntary agreement among company and local authority undertakings for improved services.

Although handicapped by lack of authority for the compulsory implementation of their recommendations, the commissioners exercised a considerable influence on the development of electricity generation and distribution. They investigated and recommended a number of regional schemes for concentrating generation of electricity in a relatively few but large power stations to be owned by joint electricity authorities. Eventually five such joint authorities were established with power to promote regional schemes, although only three reached active operation. At the same time, technical developments encouraged the commissioners to recommend that the U.K. as a whole should be considered as the appropriate generation area.

In 1925 a committee presided over by Lord Weir to review the national problem of electricity supply and to recommend methods of ensuring its most effective and efficient development, reported that there were no fewer than 572 separate undertakings, deriving their current from 438 power stations. The Weir committee recommended the construction of a national system of main transmission lines (later established as the grid) to interconnect selected

without electric light and power as the local authorities tended to establish generating stations only in densely populated areas. The supply of current by private companies received some encouragement from the Electric Lighting Act of 1888, which extended a local authority's power of compulsory purchase from 21 years to 42; but at the beginning of the 20th century the supply of electric light and power in the U.K. was far from general or efficient.

By 1900 there were in force 518 provisional orders relating to electricity supply, of which 354 had been granted to local authorities and 164 to private undertakings. By then, improvements in methods of generation and supply transmission, particularly the development of three-phase alternating current, were enlarging the economic area of supply by one station from ten square miles or less to several hundred square miles. At the same time, the development of electrically-driven machinery, tools, and other appliances was greatly extending the industrial and domestic applications of electricity.

generating stations, thereby enabling the distribution systems of public electricity authorities to be supplied on a wholesale basis with electricity produced by the most efficient stations. The Weir committee's report resulted in the Electricity (Supply) Act of 1926, whereby the electricity commissioners were required to prepare schemes for the coordination of electricity generation and to place them before the newly-constituted Central Electricity Board.

The Central Electricity Board had been set up to: (1) control and coordinate the generation of electricity in the most efficient way; (2) arrange for extensions and alterations of selected stations and for the construction of new stations on selected sites, as and when required; (3) interconnect the selected stations with one another and with the systems of authorised undertakings, by the construction of the grid; (4) standardise frequency so far as necessary for carrying out the grid schemes; (5) supply, directly or indirectly, local undertakings which required electricity for distribution, and for this purpose to purchase the output of the selected stations and sell it to the local undertakings.

Another exhaustive report, that of the McGowan committee appointed in 1936, also recommended the reorganization of electricity distribution on a regional basis under the larger and more efficient of the existing company and public authority undertakings. But the Second Great War prevented any legislative action from being taken.

Experience in the generation and distribution of electricity during the Second Great War emphasised the national value of the integration of electricity supply that had been made possible by the grid system. It also became clear that much larger distribution areas were needed. The Hydro-Electric Development (Scotland) Act of 1943 established the North of Scotland Hydro Electric Board, but there were no important legislative developments concerning electricity supply to the rest of the U.K.

CENTRAL ELECTRICITY AUTHORITY. After the Second Great War, further examination of the problem of providing efficient nation-wide current supply resulted in the Electricity Act of 1947, whereby the generation and distribution of electricity in the U.K. was transferred to public ownership on April 1, 1948. The state organiza-

tion was at first called the British Electricity Authority, but with the setting up of the South of Scotland Electricity Board in 1954, the title was changed to Central Electricity Authority. In 1958, the C.E.A. was reorganized and re-titled Central Electricity Generating Board to emphasise its function of generating and supplying electricity in quantity.

The Central Electricity Generating Board is a statutory corporation, the members being appointed by the ministry of Fuel and Power. The board owns and operates the power stations and the grid. It sells electricity to the area boards, but does not sell direct to consumers, except for electric railway traction and some supplies approved by the ministry of Fuel and Power. Branching from the Central Electricity Generating Board are 12 Area Electricity Boards, which are also statutory corporations whose members are appointed by the minister of Fuel and Power. The boards own and operate the distribution systems, and provide a variety of associated services to consumers. They buy their supplies of current from the Central Electricity Generating Board, except for some very small purchases from outside sources, chiefly collieries and the United Kingdom Atomic Energy Authority.

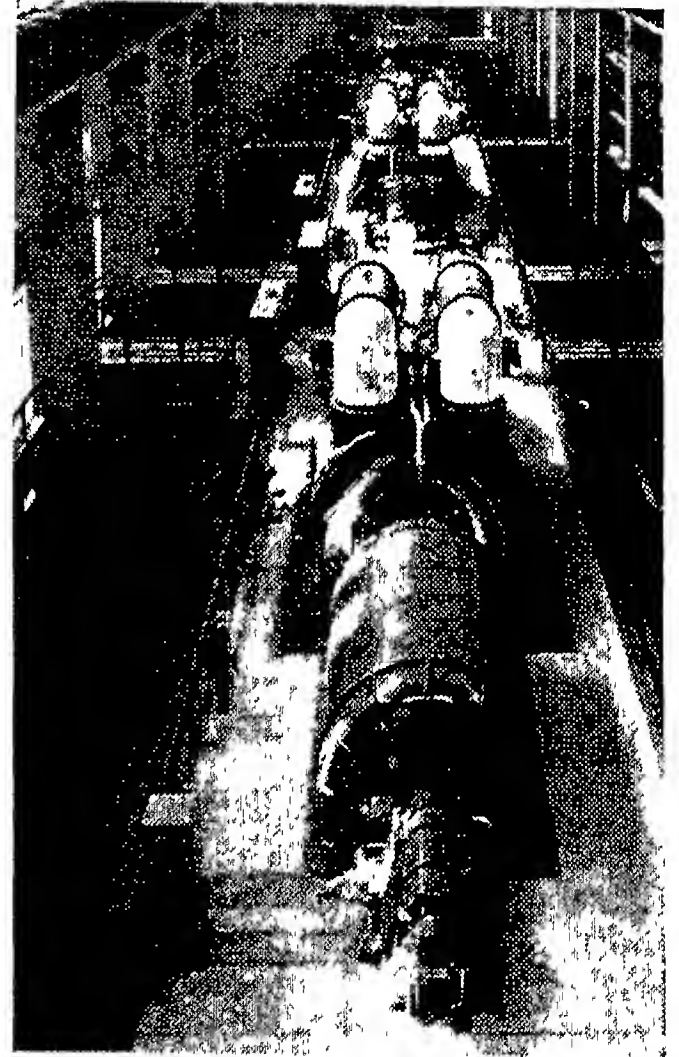
Area boards are required to promote the standardisation of systems of supply and of types of electrical fittings. The standardisation of low-voltage supplies had been under consideration for many years, and in 1945 it was decided that the adoption of an electrical pressure of 240 volts would be the practical and economic method of standardisation of alternating low-voltage supplies. Post-war credit restrictions and shortage of labour and materials delayed full implementation of a standard low-voltage supply throughout the U.K.

For the local management and operation of its power stations and grid, the Central Electricity Generating Board divides its system into 12 generating divisions, with areas corresponding approximately to those of the area boards. The board exercises a general control over the policy of the area boards, and is responsible for ensuring that the industry as a whole pays its way.

Originally, these arrangements operated throughout the whole of England and Wales and of Scotland except for the North of Scotland District, where the separate North of Scotland Hydro-

Electric Board is responsible for the generation, transmission, and distribution of current generated by water power, and for which a separate consultative council was appointed. In 1955 the generation and distribution of electric current in that part of Scotland outside the North of Scotland District was transferred to the South of Scotland Electricity Board. The North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board derive their authority from the secretary of state for Scotland.

N. IRELAND. In N. Ireland, electricity is generated by two municipal undertakings and one public board. The bulk of the current from these sources is acquired by the Northern Ireland Joint Electricity Committee, set up by statute in 1948, for sale to statutory distribution undertakings. Of these, the Electricity Board of Northern Ireland distributes electricity throughout the



Turbine hall at Brighton B power station, S. E. division Central Electricity Generating Board. The turbo-alternators generate 330,000 kW

eight counties, except in the cities of Belfast and Londonderry where it is by municipal undertakings.

GENERATION. The bulk of the U.K.'s electricity is produced in coal-fired steam-turbine generating stations. In normal times plentiful supplies of coal with good rail and coastal shipping transport for moving it, in contrast with the remote and scattered location of water-power resources, led to the preponderant development of electricity supplies from thermal generating stations in the U.K. A few

stations, notably the Bankside on the Southwark bank of the Thames, London, are oil-fired. Latterly, with the development of atomic energy, nuclear-fission became a potentially-important source of power.

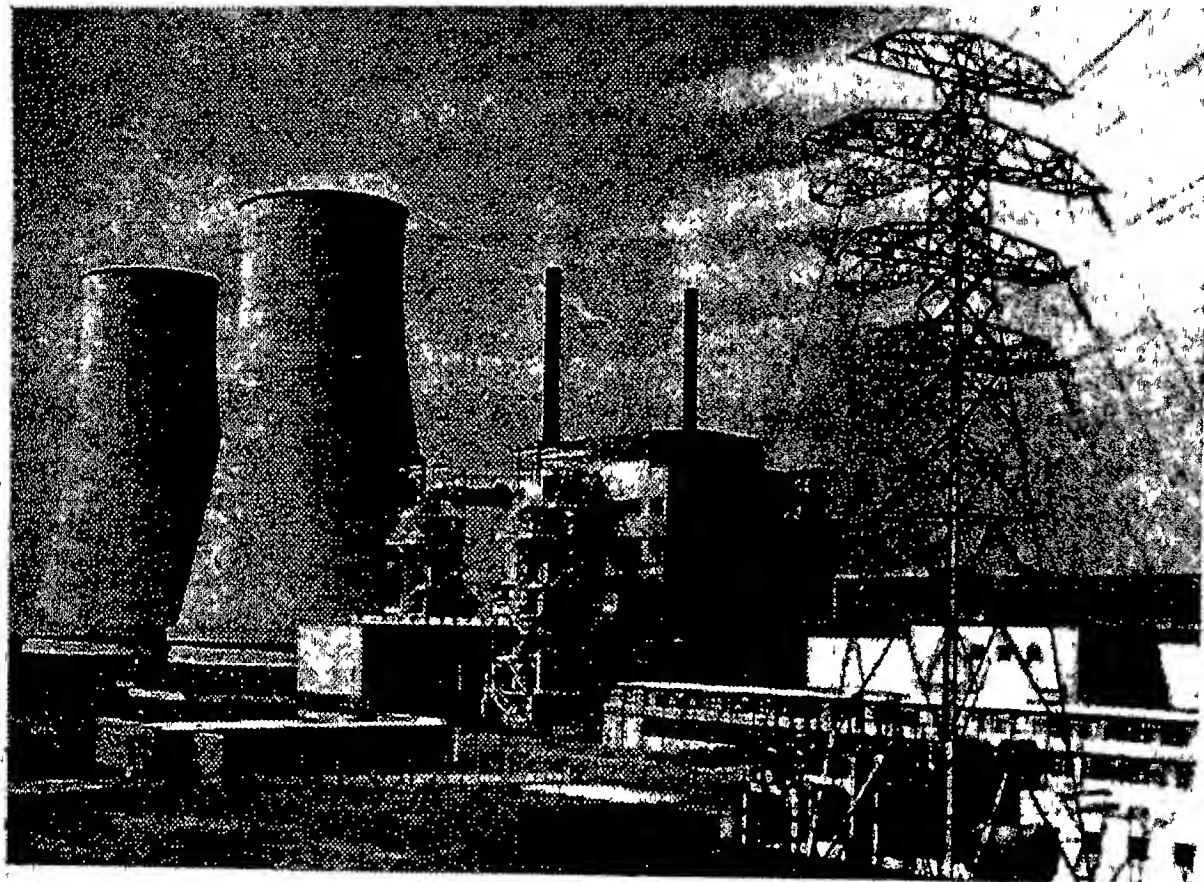
creased during the decades 1920-50 to ten times their former size, and 60,000 kilowatts in a single unit is common. They run usually at a speed of 3,000 r.p.m. and generate alternating current at a

by four chimneys each 337 feet high (from ground level) and 88 feet in circumference. Before release into the chimneys the smoke is mechanically screened and washed to remove solids and gases which otherwise would contaminate the atmosphere.

Steam from the boilers turns the shafts of the turbines, which are connected to the armatures of the dynamos. Two of the Battersea dynamos each have armatures weighing 82 tons and need turbines of 140,000 horse-power to keep them revolving at 1,500 revolutions a minute. The bearings of the turbines and dynamos run in baths containing 7,000 gallons of oil. Waste steam from the turbines is reconverted into water by condensers through which pass 2,500,000 gallons of the Thames every hour. The hot water from the condensers is then pumped to the opposite bank of the Thames, where it is used to heat blocks of flats. When all the turbines at Battersea power station are operating, they drive dynamos generating 250,000 kW: an amount of current equal to 330,000 h.p.

Approximately 97 p.c. of the electricity supply in the U.K. was in 1957 generated at some 300 steam-powered stations operated by the Central Electricity Authority. The total production of 60,500 million units of electricity (one unit equals one kilowatt hour) represented an increase of 50 p.c. in the quantity of electricity generated in the U.K. during the ten years since nationalisation of the industry. Over the same period, the average thermal efficiency (i.e. the ratio of power output to the amount of coal consumed) rose from 20.86 p.c. to 22.04 p.c.; at some stations efficiency was as high as 28 p.c.

NUCLEAR POWER STATIONS. On Feb. 15, 1955, the U.K. government announced plans for the building of 12 nuclear power stations at an estimated total cost of £300,000,000, all of which were to be in production by 1965. It was also proposed that all generating stations built after 1968 would be nuclear powered. By that time nuclear power stations in the U.K. were expected to be producing a power equivalent to that from 70,000,000 tons of coal, and supplying electric current 50 p.c. more cheaply than that derived from coal-fired generating stations. Work began on the first two stations, one at Chapelcross, Dumfriesshire, and the other at Capenhurst, near Chester, in 1957.



Calder Hall, Cumberland. Opened in 1953, this was the first nuclear power station in the U.K., and the first in the world to supply electricity for industrial and domestic use

Coal-fired or oil-fuelled generating stations must be sited where the supply of fuel is easy by rail or water; preferably by water, as a large generating station may burn as much as 2,000 tons of coal daily. There must also be available a good supply of fresh water, as steam turbines are efficient only if they run "condensing," i.e. the exhaust steam must be reconverted into water in a condenser, which requires a large supply of cooling water. A convenient method is to build the station on the banks of a river, where a system of large culverts, fitted with screens or strainers, can take several million gallons per hour from the river and return it, after use, by another system of culverts to a point farther downstream. If this is not possible, and there is no river near, the hot water from the condensers must be dealt with by cooling towers, in which the water is discharged in a fine spray from a point high up in the tower, dropping like rain into a pond below and being cooled in its journey by the rising air currents.

The boilers used are of the water-tube type, in which the water is contained in banks of tubes arranged so as to be surrounded by the hot gases from the furnace. Some of these boilers work with pressures of 1,000 lb. per sq. in.

The steam turbo-alternators which convert the energy of the steam into electrical energy in-

frequency of 50 cycles per sec. A common voltage is 11,000, but direct generation at 33,000 volts and over is steadily on the increase. Alternating current is used owing to the facility with which it can be generated at high voltage and changed from one voltage to another by a transformer (q.v.). The electricity generated is fed through switchgear, provided with the most delicate protective devices to guard against faults in any part of the apparatus, into transformers which step up the voltage to an appropriate value for transmission to the load or distribution centre.

Typical of the coal-fired generating stations in the U.K. is that at Battersea on the south bank of the Thames. Every day colliers from the north of England berth at the station's own wharf, where a battery of mechanical grabs, each with a capacity of five tons, can land 3,000 tons of coal in a few hours. The grabs drop the coal into hoppers, from which it falls on to a conveyor belt which carries it up a long slope to the top of a tower, where it is weighed and fed into storage bins each holding hundreds of tons. From the storage bins the coal is carried by another conveyor belt to the roof of the power station, whence it falls through chutes to the mechanical stokers which feed it into the boiler furnaces. Smoke from these furnaces is carried away

Much of the preliminary work that made possible the government's nuclear power programme of 1955 was jointly carried out by the British Electricity Authority and the United Kingdom Atomic Energy Authority. On Oct. 17, 1956, Queen Elizabeth II opened the first experimental power station at Calder Hall, Cumberland. Although Calder Hall was intended primarily for the production of the military atomic-explosive plutonium, it generates electric power as a by-product. The current is fed into the Central Electricity Generating Board's grid system at Whitehaven, whence it is dispersed over the N.W. area of England to towns as distant as Lancaster and Barrow. Calder Hall cost £15,000,000 to build and was the prototype of the 12 nuclear power stations due for completion in 1965. A second experimental station was opened in 1958 at Dounreay, near Thurso, Caithness. Although generating electric power for industrial and domestic use in the N. of Scotland, Dounreay was primarily intended to provide information about breeder reactors. A breeder reactor is a nuclear device which, during its production of atomic energy, produces more fissile material, or fuel, than it actually burns in its core.

A nuclear reactor, which is the basis of atomic-generated electric power, is not in itself a motive force: that is, it does not replace a mechanical source of energy such as a steam engine. Atomic energy is simply a form of fuel, and before it can do useful work it must heat the boiler of a steam turbine, which then drives an alternator which in turn generates electric power. Although the capital cost of an atomic power station is many times that of a generating station using conventional fuel, the costs of fuel transport, handling, and storage are eliminated, as one ton of uranium has the power value of a million tons of coal.

HYDRO-ELECTRIC POWER. Development of electric energy has in some places revived use of the water-wheel, one of the oldest sources of power. This is where there are waterfalls, or where dams have been built to collect water in large artificial lakes, whence it is forced by its own pressure through pipes or channels, called penstocks, to turn turbo-generators (*see* Hydro-Electric Installations).

Water power for the generation of electric power is used extensively in Europe, notably in France,

Switzerland, and Norway, and in the U.S.A., where there are the vast hydro-electric installations at Niagara Falls, Boulder Dam, and in the Tennessee Valley. In the U.K. topographical configuration and the lack of large and fast-flowing rivers limits development of hydro-electric power. Only in the N. of Scotland are these natural conditions in any way appropriate to economic hydro-electric generation; and even these were almost undeveloped until the setting up of the North of Scotland Hydro-Electric Board in 1943. Since then there has been intensive water-power development in the Highlands of Scotland.

In 1944 the North of Scotland Hydro-Electric Board drew up a development scheme for the water-power resources in its areas and listed 102 hydro-electric projects with an estimated annual output of 6,274 million units of electricity. The ultimate output of hydro-electric power in the Scottish Highlands is expected to be substantially higher and eventually may exceed 10,000 million units. In the decade 1947-57 hydro-electric power in the N. of Scotland increased from 200 million units to 900 million units.

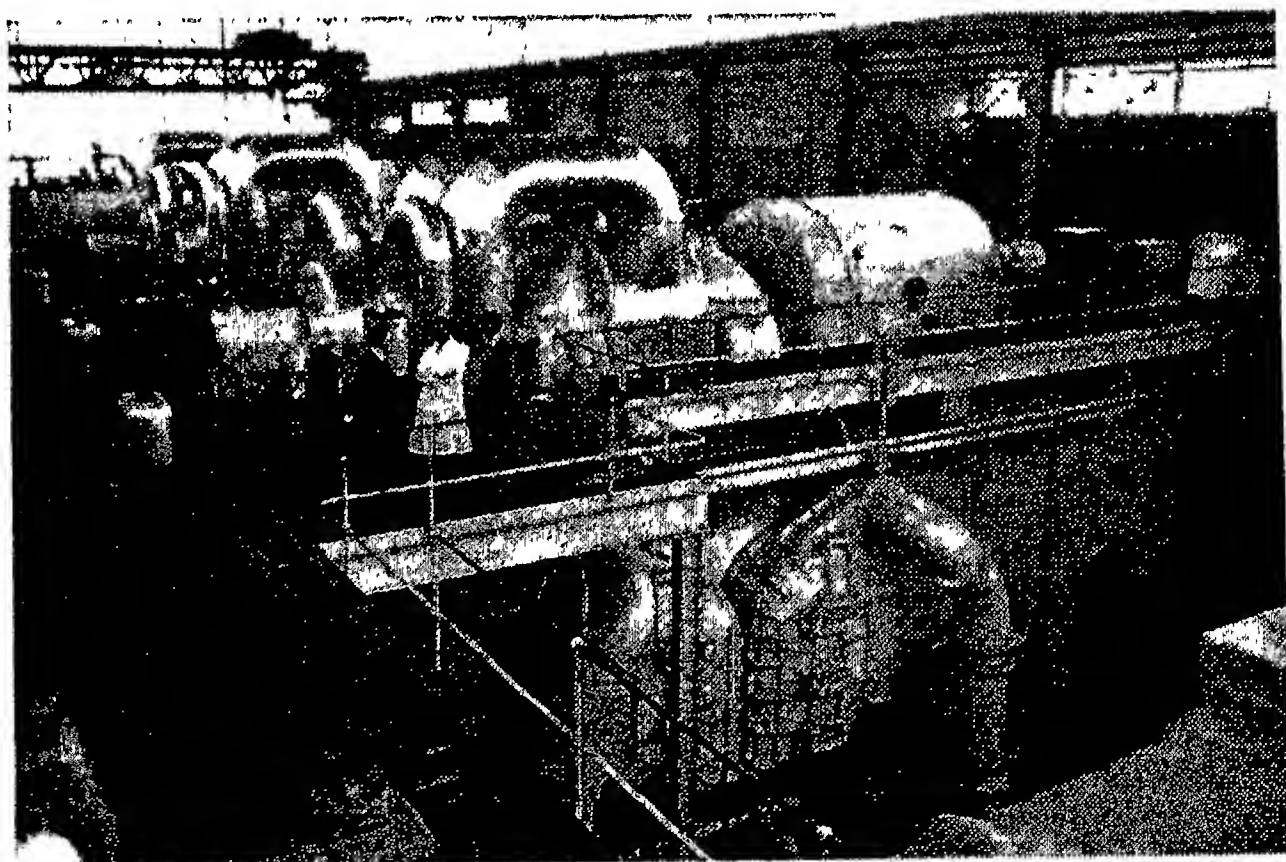
WIND GENERATORS. The windmill is probably the oldest source of mechanical power, and under

so that the blades swing round according to the direction of the wind. As the propellers turn with the wind, the shafting on which they are pivoted revolves the armature of a dynamo and so generate an electric current.

One serious disadvantage of a wind generator is that it cannot supply continuous current if the wind drops below 20 m.p.h. The Orkney wind generator overcomes this by incorporating a diesel engine which is switched on to operate the dynamo when the wind drops to zero power-level. Another method is to use the wind-generated electricity to charge storage batteries, the electric current being then tapped off as required. Although it is unlikely that wind generators will ever contribute to national electricity supplies, they have successful application in providing electricity on farms and to communities isolated from main power sources.

TRANSMISSION. Throughout the U.K., power stations generate alternating current (*see* Dynamo) which, unlike direct current, does not lose a great deal of its electrical value when sent along cables to distant users.

For long distances, the highest voltages (pressure) commercially possible should be used. Transmission voltages have risen in a most



Turbine room at Calder Hall nuclear power station. The four turbo-alternators generate a total of 92,000 kW

certain very favourable conditions may have a place in the generation of electricity. The Central Electricity Authority set up an experimental wind generator on one of the Orkney Islands, where the wind blows almost continuously. The windmill is 78 ft. high and has sails or propellers 78 ft. long mounted in a cylinder which is fixed on a swivel

spectacular manner from the 1,100 volts of the early A.C. stations, to 11,000, 33,000, 66,000, 132,000, 275,000, and even higher. The U.S. hydro-electric scheme at Boulder Dam transmits at 220,000 volts. It is believed that 500,000 volts represents the approximate maximum transmission voltage because of corona, a bluish, flame-

like discharge which forms around high-voltage conductors, causing current to leak into the ionised air.

Power stations in the U.K. generate current at a pressure of 3,300 volts. This is far too low for transmitting long distances by cable. Generated voltages are therefore stepped up by transformers to an appropriate transmission voltage (see Transformer).

Generating stations cost least to operate, and therefore produce cheaper current, when their dynamos are running continuously. If a station supplied electricity only to the area in its immediate vicinity there might be insufficient consumption of current, and for part of the day the station would have to close down. Conversely, while one station was closed down a station in another district might be unable to supply all the needs of its own area. To make the best possible use of the country's generating capacity, all major power stations in the U.K. are connected together by the grid, so called because it consists of a network of cables stretching across the length and breadth of the country. One chain of the grid extends from Dundee in Scotland down the E. side of the U.K. to Brighton. Another chain stretches from Glasgow through Swansea to Hayle in Cornwall. These two chains are linked together five times by lines crossing from the E. to the W. coasts of the U.K.

In open country the grid cables are strung from tall steel pylons and are generally of aluminium wire wound around a steel wire, but when the conductors have to be strung across wide rivers the cables are of phosphor-bronze and copper. One of the widest river crossings made by the grid is at Dagenham, Essex, where the single span of cables across the Thames is 3,060 feet suspended between two towers each 487 ft. high. Six cables, each weighing six tons, are slung between the towers. In London and other large cities and towns, the grid cables are carried through underground tunnels.

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former and switching stations, and rendering power available throughout a network that almost covers the country. The advantages of such a system can hardly be overestimated. With interconnexion, as opposed to separate small power systems, the amount of spare plant held in each station to cover breakdowns or repair periods can be cut down to a fraction of

eastwards to London. Transmission on the supergrid will be at 275,000 volts, but certain sections are designed for a possible future operation of 300,000 volts.

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A grid receiving station contains transformers sometimes 20 ft. high and weighing 120 tons, which step down to 33,000 volts, and distribute to large sub-stations



Loading desks at the Thames North control centre of the grid system. From here the current output from generating stations in a large area of England is controlled for transmission over the grid to distributing centres

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where the electricity is again stepped down to 11,000, 6,600, or 3,300 volts and further distributed to smaller sub-stations. In a town, underground cables operating at 11,000 volts terminate at small brick sub-stations or steel kiosks, containing transformers to step down to the 240 volts which is the standard distribution voltage for domestic consumers. These small sub-stations are placed at various load centres of the town, and from each radiate the 240-volt feeder cables to strategic points where, in small steel pillars or underground boxes, they are interconnected by fuses to the network of distributor cables running along the streets under the pavements. From these, at appropriate intervals, is tapped off the service cable entering each house, and terminating in a main switch and supply meter. Factories and other large consumers might be supplied direct at 3,300–11,000 volts, the necessary transformers being at the receiving premises.

Electric Shock. Term used for the effect on a human being of the passage of an electric current through the body. Up to 20 milliamperes is usually bearable by most people. From 20 to 50 milliamperes can be dangerous and harmful; above this figure death can be caused. If the current exceeds half an ampere, burning of the tissues may follow. A damp skin increases susceptibility to electric shock; persons bathing or washing are more likely to suffer if they touch a conductor.

Shocks from electricity supply mains and traction systems are frequently dangerous. Above pressures of 100 volts, death may be caused. Alternating current is more lethal than direct current, especially at low frequencies. A shock from public electricity mains is usually more serious because the distribution system has one of its conductors connected to earth. If a person comes into contact with the conductor which is not connected to earth, the current may pass through his whole body, as the victim is usually standing on some conducting medium in contact with it.

A shock received through any part of the body which will cause the current to pass through the heart may be fatal. Shocks between the hands or hands and feet are more dangerous than between the fingers of one hand or from toe to heel of one foot.

If the person is unconscious or cannot relax his hold of the live

conductor he should be pulled away from it or isolated by switching off the current or short-circuiting the conductors. When grasping the body, bare or wet hands must not be used. Insulate them with dry clothing or thick paper or other non-conducting material. A piece of dry timber can be used to push or pull the body away from the live conductor. Apply artificial respiration immediately as for cases of drowning; continue even if life seems extinct, at least until medical help can be obtained. Keep the patient warm and wrap up well, with hot water bottles or some form of heat at the feet and near the heart. Do not give stimulants except under doctor's orders. Treat burns in the usual way.

Electrochemical Equivalent.

When a quantity of electricity is passed through an electrolyte it sets free ions (*q.v.*) of the elements present. The weights of the individual ions liberated by any given quantity of electricity are proportional to their chemical equivalents. In order to correlate the available information, the electrochemical equivalent has been defined as the weight in grams of an ion liberated from an electrolyte by one coulomb of electricity. Faraday's laws show this is proportional to its chemical equivalent.

Electrochemical Series. A list of the metallic elements in the order of magnitude of their single electrode potentials (*q.v.*). The common metals run from gold, the most noble, through platinum, silver, mercury, copper, hydrogen, lead, tin, nickel, iron, zinc, manganese, aluminium, magnesium, and calcium to sodium. A metal such as zinc, later than hydrogen in the series, will liberate it from acids. A metal late in the series will displace an earlier one from a solution of its salts; *e.g.* copper is deposited by aluminium or iron.

Electrocution. Death from electric shock. The term was first used in America and originally referred to the administration of an electric shock to carry out the capital sentence on a condemned criminal; but now describes any death from electric shock.

Electrocution of criminals was first adopted by the state of New York on June 4, 1888. The first criminal so executed was William Kimmeler, at Auburn prison, Aug. 6, 1890. Electrocution for capital offences has now been adopted by 24 states of the Union.

The apparatus for carrying out the sentence of electrocution con-

sists of an alternating dynamo, capable of generating current at a maximum pressure of 2,000 volts, connected to a chair insulated from the floor and fitted with binding straps and adjustable head and leg electrodes. When the criminal has been seated in the chair, his head, chest, arms, and legs are secured with the straps; one electrode is affixed to the head, and a second to the calf of the leg. The full pressure of 2,000 volts is applied for four secs., reduced to 500 volts for one min., and again raised to full pressure for four secs. A final contact is then made to abolish reflexes in the dead body. The criminal is dead within two mins. of entering the execution chamber. Electrocution is believed to be painless and instantaneous; but scientific opinion is divided, though there is little doubt that circulation and respiration cease with the first electrical contact. See Capital Punishment.

Electrode. Term applied to the conductor from which an electric current passes into or out from a liquid or gas. Faraday distinguished the one by which the current enters as the anode, and the one by which it leaves as the cathode. In an electro-plating bath, the articles being plated constitute one of the electrodes of the bath. The term is also applied to the two carbons of an electric arc lamp and the terminals of an electric furnace, where one may be a rod of carbon, and the other the metal container of the furnace cell. The filament, plate, and grids of a thermionic valve and the plates of a battery are also called electrodes.

Electro-deposition. The production of a layer of one metal on another, by making one the anode and the other the cathode in an electrolytic cell or bath containing a solution of a salt of the metal to be deposited. See Electrolysis; Electro-metallurgy; Electro-plating; Electrotyping.

Electrode Potential. The difference of potential between an electrode and the electrolyte in an electrolytic cell, sometimes called single potential. The normal electrode potential of hydrogen is taken as zero and the values for metals are expressed in a scale based on hydrogen, ranging from negative for the base metals to positive for the noble metals. See Electrochemical Series.

Electrodynamics OR **ELECTROKINETICS.** Science which deals, in contrast with electrostatics (*q.v.*),

like discharge which forms around high-voltage conductors, causing current to leak into the ionised air.

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Electric Shock. Term used for the effect on a human being of the passage of an electric current through the body. Up to 20 milliamperes is usually bearable by most people. From 20 to 50 milliamperes can be dangerous and harmful; above this figure death can be caused. If the current exceeds half an ampere, burning of the tissues may follow. A damp skin increases susceptibility to electric shock; persons bathing or washing are more likely to suffer if they touch a conductor.

Shocks from electricity supply mains and traction systems are frequently dangerous. Above pressures of 100 volts, death may be caused. Alternating current is more lethal than direct current, especially at low frequencies. A shock from public electricity mains is usually more serious because the distribution system has one of its conductors connected to earth. If a person comes into contact with the conductor which is not connected to earth, the current may pass through his whole body, as the victim is usually standing on some conducting medium in contact with it.

A shock received through any part of the body which will cause the current to pass through the heart may be fatal. Shocks between the hands or hands and feet are more dangerous than between the fingers of one hand or from toe to heel of one foot.

If the person is unconscious or cannot relax his hold of the live

conductor he should be pulled away from it or isolated by switching off the current or short-circuiting the conductors. When grasping the body, bare or wet hands must not be used. Insulate them with dry clothing or thick paper or other non-conducting material. A piece of dry timber can be used to push or pull the body away from the live conductor. Apply artificial respiration immediately as for cases of drowning; continue even if life seems extinct, at least until medical help can be obtained. Keep the patient warm and wrap up well, with hot water bottles or some form of heat at the feet and near the heart. Do not give stimulants except under doctor's orders. Treat burns in the usual way.

Electrochemical Equivalent. When a quantity of electricity is passed through an electrolyte it sets free ions (*q.v.*) of the elements present. The weights of the individual ions liberated by any given quantity of electricity are proportional to their chemical equivalents. In order to correlate the available information, the electrochemical equivalent has been defined as the weight in grams of an ion liberated from an electrolyte by one coulomb of electricity. Faraday's laws show this is proportional to its chemical equivalent.

Electrochemical Series. A list of the metallic elements in the order of magnitude of their single electrode potentials (*q.v.*). The common metals run from gold, the most noble, through platinum, silver, mercury, copper, hydrogen, lead, tin, nickel, iron, zinc, manganese, aluminium, magnesium, and calcium to sodium. A metal such as zinc, later than hydrogen in the series, will liberate it from acids. A metal late in the series will displace an earlier one from a solution of its salts; *e.g.* copper is deposited by aluminium or iron.

Electrocution. Death from electric shock. The term was first used in America and originally referred to the administration of an electric shock to carry out the capital sentence on a condemned criminal; but now describes any death from electric shock.

Electrocution of criminals was first adopted by the state of New York on June 4, 1888. The first criminal so executed was William Kimmeler, at Auburn prison, Aug. 6, 1890. Electrocution for capital offences has now been adopted by 24 states of the Union.

The apparatus for carrying out the sentence of electrocution con-

sists of an alternating dynamo, capable of generating current at a maximum pressure of 2,000 volts, connected to a chair insulated from the floor and fitted with binding straps and adjustable head and leg electrodes. When the criminal has been seated in the chair, his head, chest, arms, and legs are secured with the straps; one electrode is affixed to the head, and a second to the calf of the leg. The full pressure of 2,000 volts is applied for four secs., reduced to 500 volts for one min., and again raised to full pressure for four secs. A final contact is then made to abolish reflexes in the dead body. The criminal is dead within two mins. of entering the execution chamber. Electrocution is believed to be painless and instantaneous; but scientific opinion is divided, though there is little doubt that circulation and respiration cease with the first electrical contact. See Capital Punishment.

Electrode. Term applied to the conductor from which an electric current passes into or out from a liquid or gas. Faraday distinguished the one by which the current enters as the anode, and the one by which it leaves as the cathode. In an electro-plating bath, the articles being plated constitute one of the electrodes of the bath. The term is also applied to the two carbons of an electric arc lamp and the terminals of an electric furnace, where one may be a rod of carbon, and the other the metal container of the furnace cell. The filament, plate, and grids of a thermionic valve and the plates of a battery are also called electrodes.

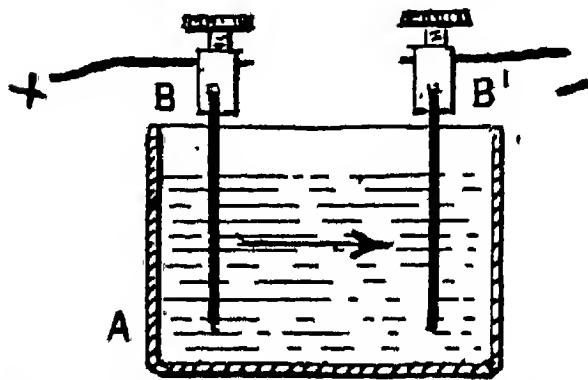
Electro-deposition. The production of a layer of one metal on another, by making one the anode and the other the cathode in an electrolytic cell or bath containing a solution of a salt of the metal to be deposited. See Electrolysis; Electro-metallurgy; Electro-plating; Electrotyping.

Electrode Potential. The difference of potential between an electrode and the electrolyte in an electrolytic cell, sometimes called single potential. The normal electrode potential of hydrogen is taken as zero and the values for metals are expressed in a scale based on hydrogen, ranging from negative for the base metals to positive for the noble metals. See Electrochemical Series.

Electrodynamics OR **ELECTROKINETICS.** Science which deals, in contrast with electrostatics (*q.v.*),

with the motion of electricity, *i.e.* with current electricity. Ampère's work in 1820 laid the fundamental laws governing the subject. See Electricity.

Electrolysis. Decomposition of liquids by electric current. The liquid which undergoes such action is called an electrolyte (*v.i.*). Water may be entirely decomposed into its two elements, oxygen and hydrogen, the gases being liberated at opposite sides or ends of the apparatus—a cell—in which the operation is carried out. With solutions, *e.g.* sulphate of copper in acidulated water, the decomposition may be only partial, while under suitable conditions, though decomposition goes on, the state of saturation of the solution will be maintained.



Electrolysis. Fig. 1. Diagrammatic view of cell for decomposition of liquids by electric current. See text

The elements necessary for the exhibition of this phenomenon are shown in the accompanying diagram (Fig. 1): A is the container, which must either be of a material which is non-conducting electrically or be insulated so that the current of electricity will not pass through it; while B, B¹ are two conductors immersed in the liquid, each being provided with an arrangement by which it may be connected to a source of electricity. The combination constitutes a cell. The current enters the cell at B, which thus becomes the positive pole or anode of the element, and, after traversing the bath, escapes at B¹, which is thus the negative pole or cathode, these poles being distinguished by + and — symbols.

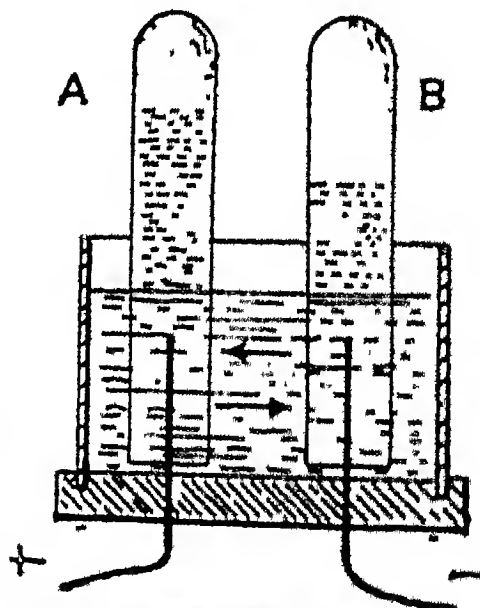
If the conductors be two strips of platinum and the liquid water, then, when the current passes, oxygen is liberated at the surface of the anode and hydrogen at the surface of the cathode. The two gases may be easily collected by an arrangement indicated in Fig. 2, which represents the original voltameter. A and B are inverted glass test tubes, each having introduced into it at the bottom one of the electrodes. The tubes are first filled with the electrolyte—the water, which is usually slightly acidulated to facilitate the action

—and when the current passes, the gases which are released at the surfaces of the electrodes rise to the top of the tubes and displace the liquid. Two notable points are to be observed here: the gases collect separately, and no action whatever is apparent in the body of the bath between the two tubes. But when oxygen in the one tube is set free, hydrogen must be liberated at the same instant; the latter does not, however, collect side by side with the oxygen in the tube where it is separated, but by some invisible action passes out of that tube across the bath and appears in the other tube. Similarly, there must be a migration of the oxygen from the hydrogen collecting tube back to the oxygen tube. Thus one of the elements separated travels with the electric current and the other against it; to the former Faraday gave the name *cation*, meaning that which goes down, and to the latter the term *anion*, or that which goes up. The theory is advanced, and reference should be made to a textbook on physics.

The phenomenon of electrolysis is not only profoundly interesting scientifically; it has received industrial applications of the first importance. Electro-metallurgy depends largely upon it; electroplating wholly. The phenomenon may not, however, be always beneficial. In industrial practice the electric current is generated and caused to flow through the cells by means of a dynamo; but a current may be induced in the cell itself, as in the ordinary voltaic or galvanic batteries, by the employment of two dissimilar metals immersed in a suitable electrolyte. A current may even be set up between two metals of the same kind, provided there be a slight difference in their molecular or chemical structure. Such a current may be sufficient to set up electrolysis if other conditions are favourable. Hence machinery or metal structures immersed in water, or in solutions, may present the conditions necessary to set up electrolytic action and decomposition. For the uses of Electrolysis in medicine, and the conditions treated with it, see Electrotherapeutics; see also Electro-Metallurgy; Voltameter.

Electrolyte. Conducting solution which will dissociate into particles, or ions, on the passage of an electric current. The solution may be composed of a salt dissolved in water or fused, either by itself or with other salts or acids. The positively charged particles, cations, will proceed to the negative electrode or cathode, while the anions go to the anode. Thus, if a current be passed through a dilute solution of common salt, NaCl, the sodium cations, Na⁺, will go to the cathode and the chlorine anions, Cl⁻, to the anode. Once they reach their respective electrodes, the ions lose their charges and re-form atoms, which may be liberated as a gas, deposited as a solid, or react with the solution. In the example, chlorine gas is liberated at the anode, but the sodium reacts with water to form caustic soda at the cathode. But if, instead of being dissolved in water, the salt were to be fused, electrolysis of the melt would give pure sodium and chlorine. Pure water will not readily conduct electricity, but the addition of very small amounts of molecular compounds which will ionise, such as acids or salts, renders it an excellent electrolyte, as it splits up into its component atoms of hydrogen and oxygen. See Electrolysis; Ion.

Electrolytic Polishing. Process for imparting a bright lustre to metal objects instead of the duller surface resulting from electroplating. It consists of reversing the current flow through the electrolyte, so that the object treated forms the anode instead of the cathode. A minute amount of the metal surface is removed by the treatment, leaving a bright, smooth finish. Silver plated objects, for example, need no subsequent buffing; objects of complex shape, which it would be impossible to polish by mechanical methods, are turned out with a lustrous surface direct from the bath. The electrolyte is an acid solution which varies with the metal to be "electro-polished."



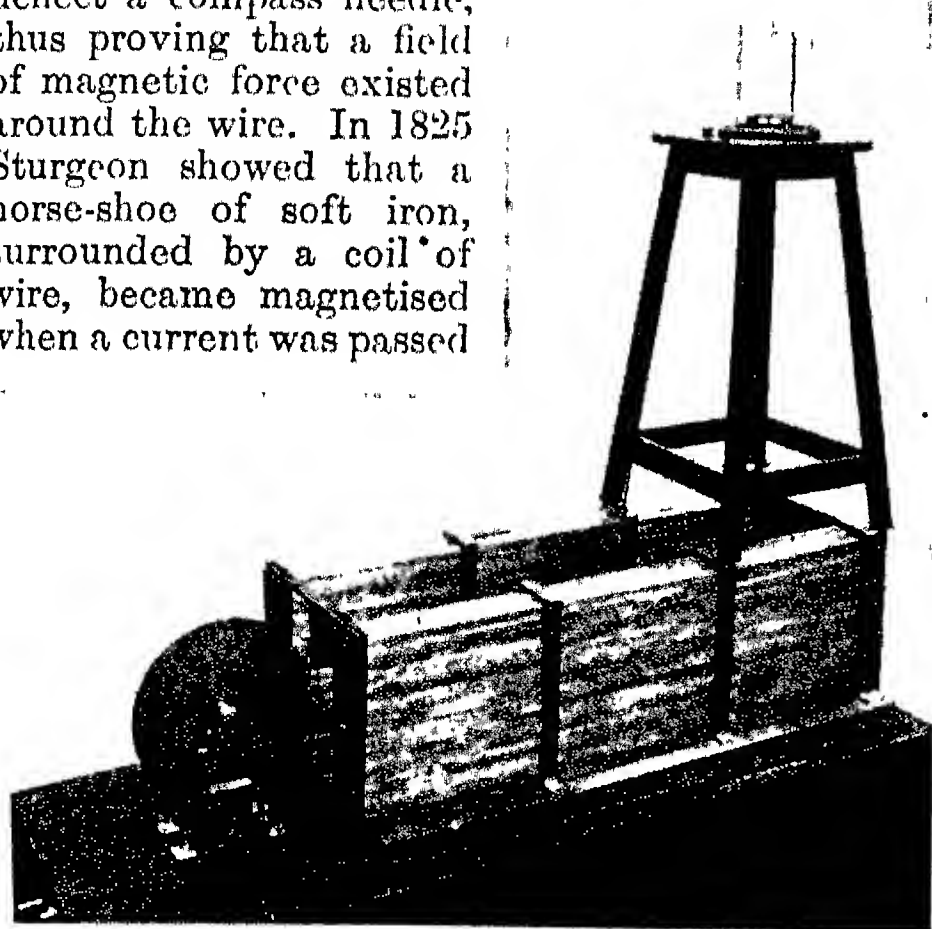
Electrolysis. Fig. 2. A and B are inverted test tubes collecting the oxygen and hydrogen set free from water by electrolytic action

Electro-Magnetic Machine. Term covering virtually every type of electrical machine met with outside a laboratory. At one time, electricity and magnetism were thought to be totally different

phenomena, but in 1820 the famous Oersted experiment proved them to be inter-related. Oersted (*q.v.*) found that a wire carrying an electric current would deflect a compass needle, thus proving that a field of magnetic force existed around the wire. In 1825 Sturgeon showed that a horse-shoe of soft iron, surrounded by a coil of wire, became magnetised when a current was passed

through the coil, thus producing the first electro-magnet. In that part of the disk which lies between the magnet poles at any given instant.

From this it is a simple step to an elementary generator consisting of a single conductor bent into a loop or single-turn coil, rotating between the poles of a magnet as shown in Fig. 2. Each end of the loop is connected to a collector or slip-ring with a brush making rubbing contact to connect the loop to an external circuit. At any given instant each half of the loop is cutting the field in opposite directions (Fig. 3), so that, as the conductor is doubled back on itself,

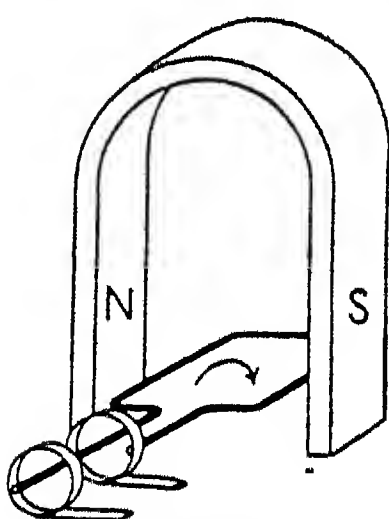


Electro-Magnetic Machine. Fig. 1. Faraday's magnet and disk, 1831. Earliest form of electro-magnetic machine. Crown copyright. From an exhibit in the Science Museum, S. Kensington

through the coil, thus producing the first electro-magnet.

It was left to Faraday to prove the converse of Oersted's conclusion—that a conductor in a changing magnetic field, *i.e.* a field which was either growing

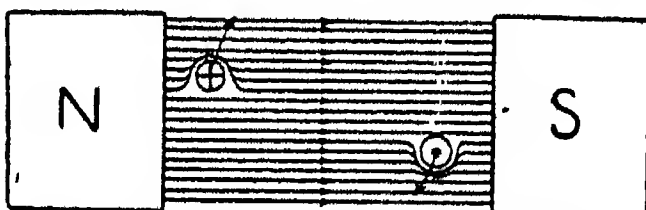
stronger or dying down, had a current induced in it. He reasoned that a conductor which moved in a stationary magnetic field, cutting the lines of magnetic force, would also have a current induced in it.



Electro-Magnetic Machine. Fig. 2. Elementary machine with single-turn coil or loop revolving between magnet poles. Note collector or slip rings

His apparatus, from which developed the electrical machine, consisted of a copper disk rotating between the poles of a permanent magnet (Fig. 1). Rubbing contacts on the rim of the disk and the axle collect the current in-

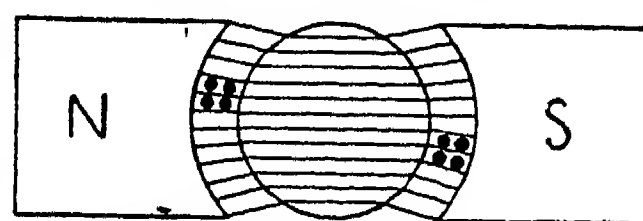
duced in that part of the disk which lies between the magnet poles at any given instant. From this it is a simple step to an elementary generator consisting of a single conductor bent into a loop or single-turn coil, rotating between the poles of a magnet as shown in Fig. 2. Each end of the loop is connected to a collector or slip-ring with a brush making rubbing contact to connect the loop to an external circuit. At any given instant each half of the loop is cutting the field in opposite directions (Fig. 3), so that, as the conductor is doubled back on itself,



Electro-Magnetic Machine. Fig. 3. Diagram showing the two sides of a revolving loop cutting a magnetic field in opposite directions

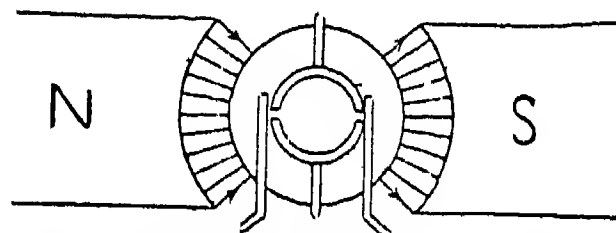
put of the machine to the point where it has practical value.

As one coil-side only reaches a position midway between the poles, it ceases to cut the field and the electro-motive force drops to zero—to rise again in the opposite direction. The current flowing in the external circuit from the brushes is an alternating one, its frequency of reversal being proportional to the speed of



Electro-Magnetic Machine. Fig. 4. Development of the elementary machine: multi-turn coil revolving in concentrated field produced by pole-pieces and iron core

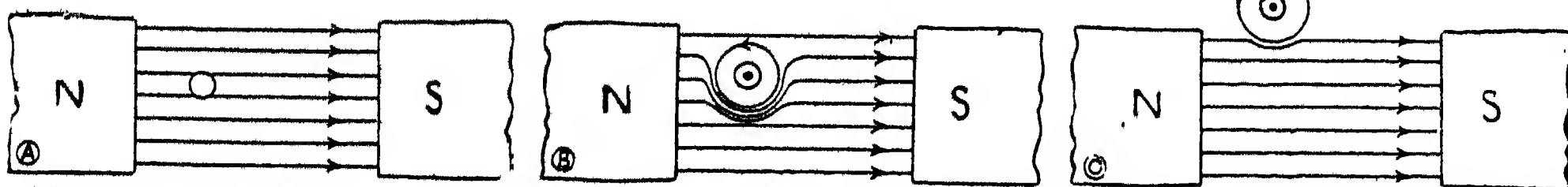
rotation. If direct current is required, some device must be added to reverse the connexions between the coil and the external circuit at each revolution. A commutator in its simplest form is made by replacing the slip-rings by a single collector-ring or tube which is split lengthwise into two sections insulated from each other and from the shaft. One end of the loop or coil is connected to each half so that, as the coil revolves, the connexions to the brushes are automatically reversed in step with the alternations of the



Electro-Magnetic Machine. Fig. 5. Elements of commutation: connexions to brushes are being reversed before coil re-enters magnetic field

electro-motive force. This produces a unidirectional current in the external circuit (Fig. 5). Such a machine may be regarded as the forerunner of the direct-current generator or dynamo (*q.v.*).

REVERSIBLE ACTION. Besides converting mechanical power into electrical energy, it is possible to reverse the action, so that electrical power supplied to a coil in a magnetic field is made to produce rotation, and hence mechanical energy. The action can be understood by reference to Fig. 6, where A represents a conductor carrying no current, lying in a magnetic field. When a current is passed through it, as at B, it becomes surrounded by its own magnetic field (represented by the circle). This, interacting with the field due to the magnet (N.S.), tends to bend its lines of force, which may be regarded as elastic and, in trying to straighten themselves, push



Electro-Magnetic Machine. Fig. 6. Motor principles: A. Conductor carrying no current; B. Field produced around conductor distorting main field; C. Main field straightens out, forcing conductor to move out of field

the conductor out of the field. A machine with a commutator can produce continuous rotation, and thus function as an electric motor, the speed being governed by the strength of the magnetic field, by the current passing through the coil, and by the mechanical load applied. A machine without a commutator will also run as a motor when supplied with *alternating* current; but only at one speed, corresponding to the frequency of alternation of the supply—i.e. it is a *synchronous* machine.

CLASSIFICATION OF MACHINES. *Generators* convert mechanical into electrical energy; they fall into two main classes, the direct-current (D.C.) generator or dynamo, and the alternating-current (A.C.) generator or alternator (*q.v.*). *Motors* convert electrical into mechanical energy; they may also be divided into two main classes, D.C. and A.C.; while A.C. motors can be further subdivided into synchronous and asynchronous machines, the latter capable of delivering power at other speeds than that fixed by the frequency. (See Motor, Electric.) *Converters* are machines which change electrical energy of one type or pressure to electrical energy of another type or pressure. They fall into three groups: A.C.-D.C. (or vice-versa); A.C.-A.C.; and D.C.-D.C.

Current Conversion

Alternating to direct conversion is the principle in (a) *Motor-generators*, in which a straightforward A.C. motor is mechanically connected to a straightforward D.C. generator; (b) *Rotary converters*, consisting of a single machine built like a D.C. generator, but with the addition of slip-rings whereby A.C. is fed into the rotating conductors, to reappear as D.C. at the commutator. The machine can be regarded as a synchronous A.C. motor and a D.C. generator condensed into one machine, with all parts in common. (c) *Motor converters*, which consist of two machines, outwardly resembling a plain motor-generator, but more complicated in that the rotating conductors of the two machines are electrically as well as mechanically connected. The A.C. end functions half as a motor and half as a transformer, while the D.C. end functions half as a plain D.C. generator and half as a rotary converter.

A.C.-A.C. converters can be divided into *transformers* for changing from one voltage to

another, and *frequency changers*. The transformer, although a true electro-magnetic machine, has no moving parts, but works on the principle of Faraday's earliest induction experiments. Two coils are magnetically linked by an iron core. The primary coil is excited by an alternating voltage, and the changing magnetic field which it produces induces an alternating voltage of the same frequency in the secondary coil. This secondary voltage is proportional to the ratio of the number of turns in each coil, so stepping up or down is simple. Frequency changers are what their name implies, and may be regarded as motor-generators with two A.C. machines.

Stepping Direct Current

Direct current cannot be changed from one voltage to another without rotating machinery. Motor-generators can be used, with both machines arranged for D.C., and there are two special machines, the *rotary transformer* or *dynamotor* (*q.v.*) and the *metadyne* (*q.v.*) or *amplidyne*. The former may be regarded as a motor and a dynamo with two sets of rotating conductors and two commutators, revolving in a common magnetic field. It can convert D.C. from one voltage to another in a fixed ratio only which is decided when the machine is built. The second class of D.C.-D.C. converter, developed in 1932, consists of a direct-current motor with a second set of brushes operating on a different part of the commutator. By varying the method of connexion, and by the addition of extra windings on the field-magnet system, it can be made to perform extraordinary duties, e.g. operating as a constant-current D.C. transformer of infinitely variable ratio; or acting as a power amplifier.

Electro-Magnetic Wave.

Wave consisting of an electric force and a magnetic force, set up in a dielectric in directions perpendicular to each other and both perpendicular to the direction of propagation. The existence of these waves was predicted by Clerk-Maxwell in 1855-64 and verified in 1887-88 by Hertz; and both initial theory and experimental confirmation were such brilliant investigations that their results were epoch-making.

The waves originally recognized by Clerk-Maxwell as electro-magnetic were those due to the sudden release of a charge on an insulated conductor, such as the sparking across of a sphere-gap.

Starting from the assumption that this sudden release of energy was of the same nature as a mechanical blow upon an elastic material, he argued that a similar series of vibrations would occur, and proceeded to calculate their velocity of propagation and other properties by means of the same relationships.

Now the velocity of propagation of a shock or sound in air, or an impulse through an elastic solid, is given by $v = \sqrt{e/\rho}$, where e is the elasticity (i.e. stress/strain), and ρ is the density of the material. The electrical equivalent for elasticity is $Q/\epsilon r^2 \times 4\pi r^2/Q = 4\pi/\epsilon$,

where ϵ is the dielectric constant; for density, $4\pi\mu$, where μ is the permeability of the medium. Substituting, this gives $v = \sqrt{1/\epsilon\mu}$, which works out at 3×10^{10} cm. per sec., or 186,000 miles per sec. Thus the velocity is identical with that of light, and the waves travel in the same medium. The conclusion is, therefore, that light waves are also electro-magnetic. Maxwell deduced further that every transparent substance must be an insulator, and that the dielectric constant (specific inductive capacity) of any dielectric would equal the square of its refractive index.

Hertz's Simple Apparatus

The apparatus devised by Hertz for generating and detecting the waves was quite simple; but his demonstration of their compliance with Maxwell's equations and predictions was so graphic as to be almost sensational. He used the discharge of a sphere-gap, charged by an induction coil, as his source. Such a discharge creates a low resistance path for itself by its initial spark, through which the opposite charges in the two spheres rush together, and then overshoot, reversing the polarity of the spheres and continuing the process until damped out by circuit losses; much as the levels of the liquid in the two arms of a U-tube will oscillate after their relative heights have been disturbed. The spheres were fixed to metal rods in line with each other, bearing metal plates at their outer ends, into which the oscillating charges surged. Waves due to the movement of the charges were radiated through space, and could be detected by means of a similar sphere-gap joined by a circular loop of wire. When the length of the wire is such that the period of oscillation is the same as in the generating circuit, small sparks pass across the

gap. Thus the principles of resonance and tuning of an oscillating circuit were illustrated.

Having devised means for creating and detecting the waves, Hertz proceeded to show their similarity to light waves by reflecting them from a metal plate, refracting them with a prism made of pitch, and polarising them with a metallic grid. Finally, he formed a standing wave by causing the original wave to interfere with its own reflection, and by measuring the distance between successive nodes located by his detector, he found the wave-length, and verified the velocity of propagation. He confirmed that the waves were identical with light in all but wave-length or frequency.

Electro-Magnetic Energy

Although the waves were generated by electrostatic means, it is not difficult to show that they contain electro-magnetic energy as well. Before the charged spheres begin to discharge, their energy is entirely electrostatic and equal to $\frac{1}{2} CV^2$, where C is the capacity and V the voltage. The spheres are, in fact, a charged condenser, with the insulating medium between them—here the air forming a dielectric in a state of strain. Immediately the discharge begins, however, a current flows between them, relieving the strain in the dielectric, but creating a magnetic field in the space round the conducting rods. At the instant when the voltage between the spheres is zero and is about to reverse, the dielectric strain has disappeared and the electrostatic energy has vanished; but the current is a maximum and therefore the electro-magnetic energy, equal to $\frac{1}{2} LI^2$, where L is the inductance and I the current, is also a maximum. The energy keeps changing from electrostatic to electro-magnetic and back again, until the oscillation is damped out through resistance, dielectric, and eddy-current losses. The wave-lengths were of the order of 100–1000 m/s.

Employing the values for the energy given above and assuming negligible resistance, the period of oscillation τ is given by

$$\tau = 2\pi \sqrt{LC} \text{ sec.},$$

and the frequency f in cycles per sec. by

$$f = 1/\tau = 1/2\pi \sqrt{LC}.$$

The wave-length λ is given by

$$\lambda = 300/f \text{ metres}$$

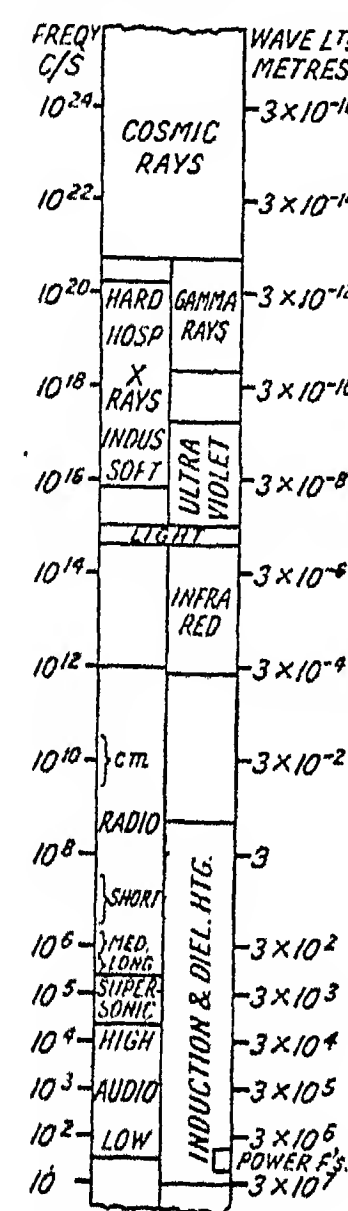
$$= 1885 \sqrt{LC} \text{ metres},$$

where f is in megacycles per sec., L in microhenries, and C in microfarads.

Visible light is produced at wave-lengths ranging from 0.4 microns (violet) to 0.7 microns (red). Atomic physics has revealed the mechanism whereby light rays (including infra-red and ultra-violet) are formed. Each element is characterised by a fixed number of electrons circling round the nucleus. These keep to definite orbits, each having a definite radial distance from the com-

mon centre. But if a substance is heated, some of the electrons in its atoms are able to move at high frequency from their own orbits to the next farther from the centre and back again; and as electrons are negative charges of electricity, they give out electro-magnetic waves when they oscillate.

An electro-magnetic spectrum is given in the figure, showing the relative position of visible and invisible light, and below them radio waves belonging to the various bands, audio-frequency waves, with those of supersonic frequency between the last two; while above the light waves are X-rays, gamma rays, and cosmic rays.



Electro-Magnetic Wave. Table of an electro-magnetic spectrum, showing visible and invisible light, X-rays, radio, etc.

Electro-Magnetism. Term used for the branch of science which deals with the connexion between electrical and magnetic phenomena. In 1820 Hans Christian Oersted (*q.v.*) discovered that a wire conveying an electric current is surrounded by a magnetic field, and that a freely moving magnetic needle sets itself along a tangent to a circle surrounding the wire. Oersted's discovery was followed by the researches of D. F. J. Arago and A. M. Ampère and others, but it was Faraday who showed how to obtain electricity from magnetism, and thus laid the foundations of the electrical industry. See Electro-Magnetic Machine.

Electro-Metallurgy. Term used to describe those processes in metallurgy in which electricity supplies the energy. The scope is vast, covering all fields of metallurgy: the extraction of metals from their ores, refining, fabrication, joining, etc. Few metal articles are produced without being subjected to at least one electro-metallurgical process at some stage. The action of the electric current may be purely electrolytic (*see* Electrolysis), or electricity be used merely to generate heat. In the electrolysis of fused salts, both effects are used. Some other subjects included in the broad classification are described under individual headings (*see* Electric Welding; Electro-plating). Electro-metallurgy was born soon after Volta's discovery of the galvanic cell. Davy demonstrated the electric arc in 1807; Faraday carried on the work; Elkington developed electrolytic processes in England; and, once the dynamo was introduced, the industry grew rapidly.

Apart from electro-plating, the electrolysis of salts in water solution is used in two ways in metallurgy: for the extraction of metals from their ores, and for the refining of metals. Fundamentally the processes are similar. In both the metal is deposited electrolytically from a solution of its salts on one electrode of a cell; but in refining the other electrode is composed of the impure metal and dissolves continually, keeping the metallic content of the bath virtually constant. The impurities either remain in the solution or form a sludge which can be removed periodically. Copper was the first metal to be refined electrolytically by Elkington and is still the most widely treated.

The Refining of Metals

Impure "blister" copper contains not only undesirable impurities, such as nickel, arsenic, selenium, tellurium, and antimony, but also varying amounts of gold, silver, and platinum. These are recovered by electrolytic refining and their value often repays the cost of the whole process. The crude copper, cast into anodes weighing 500–800 lb. each, is placed in a solution of copper sulphate, containing 15–20 p.c. of free acid and held in lead-lined tanks. In the multiple system these copper anodes alternate with thin sheets of pure copper, which form the cathodes. When the current is passed, the impure

anodes gradually dissolve over a period of about 30 days and pure copper is deposited on the cathodes. The bulk of the metallic impurities remains in the solution; the precious metals form an insoluble slime which is collected.

Silver can be refined in a solution of silver and copper nitrates. In the Thum cell, the bottom is itself the cathode and the impure silver anode is held in a canvas bag above it. The silver is deposited in crystals, as it is in the Moebius cell, where anodes and cathodes are arranged much as in copper refining. Stainless steel cathodes are used and the pure silver crystals are scraped off by wooden paddles. Gold is refined by the Wohlwill process, using a hot acid solution of gold chloride. High current densities are used and the electrolyte stirred. The cathodes are gold strip.

Nickel is frequently refined electrolytically in nickel sulphate solutions containing boric acid. The anodes and cathodes are separated by canvas, and usually aluminium sheets are used as starting blanks for the cathodes. Lead can be refined by the Betts process, which uses a system of multiple connexion: the bath is a solution containing lead fluosilicate and hydrofluosilicic acid. Bismuth, tin, iron, and antimony are other metals, that can be refined electrolytically.

Extraction of Low Grade Metals

Electrolytic extraction of metals is mainly confined to those low grade ores which have a considerable proportion of their metallic content present in a readily soluble form. Copper is the metal most extensively extracted in this way; zinc is increasingly so, the ore being first roasted and then leached with sulphuric acid. Cadmium and manganese are further examples. Metals extracted by electrolysis of their fused salts are aluminium, magnesium, beryllium, sodium, lithium, calcium, and cerium. In general the processes depend upon two factors: fused salts behave electrolytically much as their aqueous solutions do, but they are better conductors of electricity; further, electrical resistance heating will usually keep them molten. The electrolysis of fused sodium chloride, for example, results in the liberation of sodium at the cathode and chlorine at the anode. Sometimes the fused salts merely act as carriers for the material electrolysed, e.g. alumina. Magnesium chloride,

however, is itself fused and electrolysed to produce pure magnesium. Usually the electrical power supplies the energy not only for electrolysis but also for heating the cells and so fusing the salts.

In a third important branch of electro-metallurgy, electricity is used solely as a source of heat. No combustion method can compare with electricity in the speed at which great heat can be directed exactly where it is wanted. Electric furnaces (*q.v.*) fall into three groups: resistance furnaces, used in the laboratory and in small scale operations; arc furnaces, for smelting iron and steel and the production of ferro-alloys for steel manufacture; and induction furnaces, restricted chiefly to the non-ferrous field.

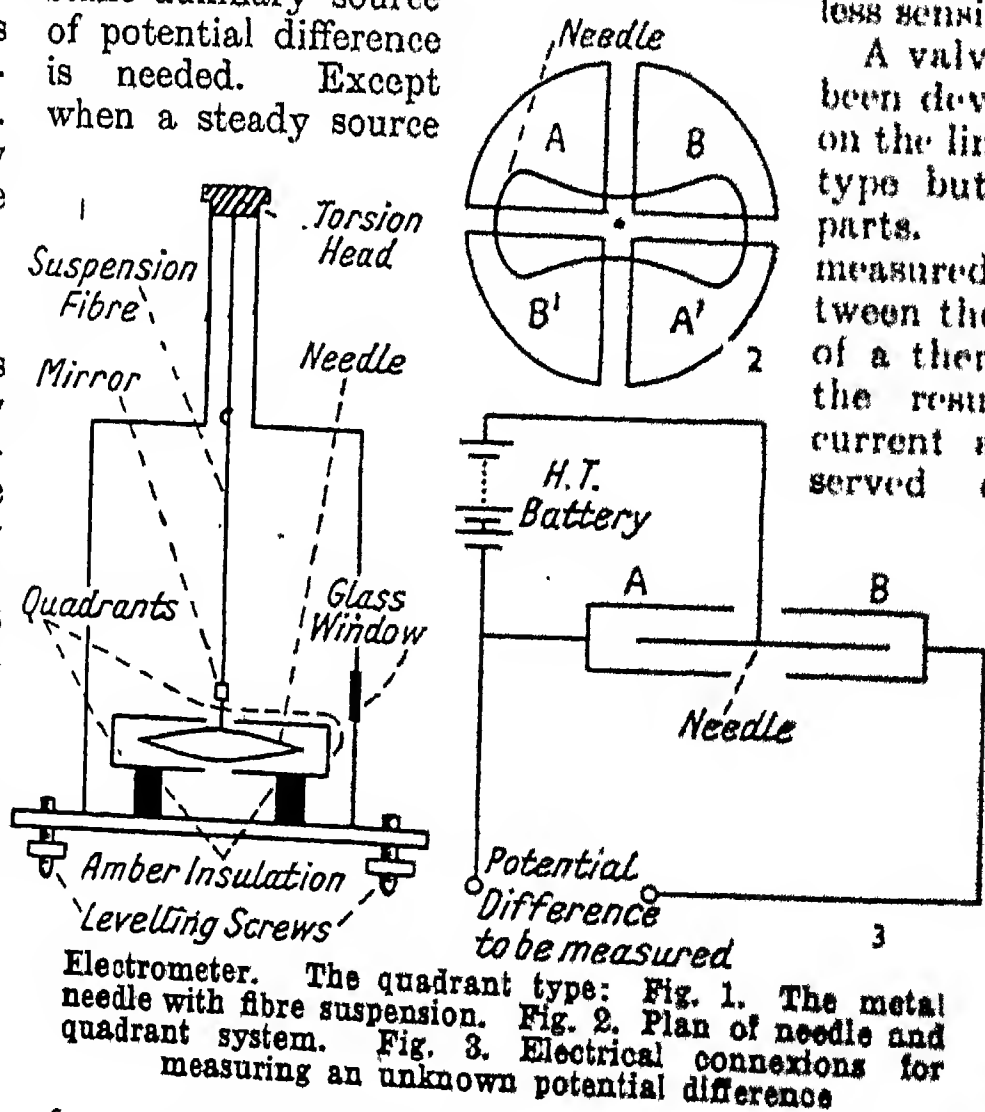
Electrometer. An instrument for determining potential differences by the measurement of the displacements of charged conductors under the action of electrostatic forces. The insulation of the electrodes of such instruments is usually extremely good; they do not require a continuous electric current for their operation, although a constant auxiliary source of potential difference is needed. Except when a steady source

produce frictional charges. Electrometers also measure small currents such as occur in ionisation chambers. In this application, the instrument should have as small an electrical capacity as possible.

Until recently the quadrant electrometer has been most used. It consists of a thin metal needle (Fig. 1) suspended by a phosphor-bronze or silvered quartz fibre so that it hangs within a shallow circular box formed by four fixed metal double quadrants each separated by a narrow air gap. Opposite quadrants, A and A', B and B', are electrically connected (Fig. 2). A schematic diagram of electrical connexions for measuring an unknown potential difference is shown in fig. 3. If the high tension battery is omitted and the needle is therefore directly connected to quadrants A and A', then the deflection will be in the same sense whatever the direction of the applied potential difference, and the electrometer will measure alternating voltages. Electrostatic voltmeters, often designed after the principle of the quadrant electrometer, are more robust but less sensitive.

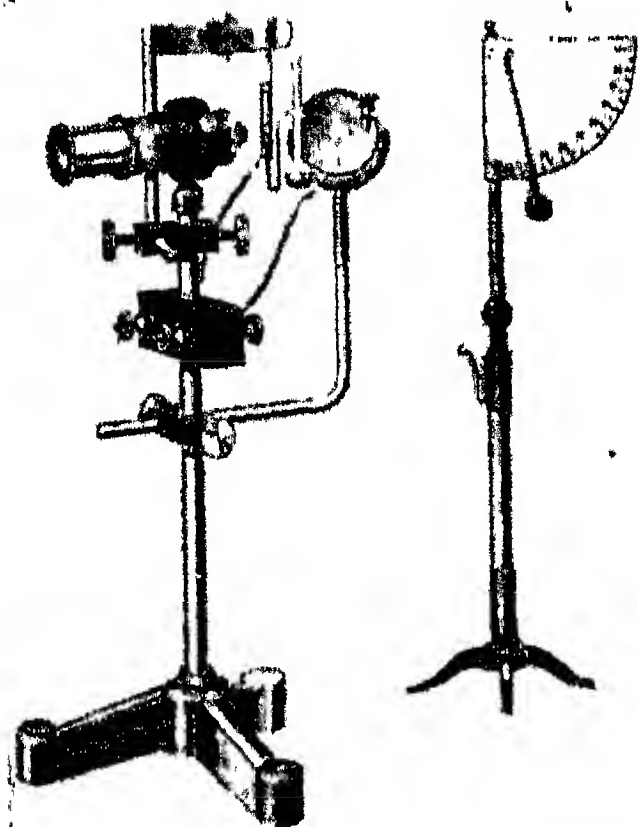
A valve electrometer has been developed to operate on the lines of the quadrant type but without moving parts. The p.d. to be measured is applied between the cathode and grid of a thermionic valve, and the resulting change of current at the anode observed directly. Valves can be of the triode or screened grid types, and are specifically designed to reduce the grid current to a minimum, so that current drawn from the circuit under test with the valve type of electrometer is negligible.

Other devices are: (1) The string electrometer, simple in construction and with the advantage, for small current measurement, of having the very small capacitance of about 5 micro-microfarads. It consists of a fine silvered quartz or Wollaston wire which is maintained taut at right angles to the electric field deriving from, and maintained between, two parallel electrodes. Any



of potential difference is being measured, the electrometer should be surrounded by an earthed shield to prevent the induction of electrical charges on the system brought about by the movement of charged bodies in its neighbourhood. Any switches used for making electrical contacts in the system must be free from contact E.M.F.s; sliding surfaces should be avoided, as they are liable to

change in the potential of the string will result in its displacement, which can be observed with a microscope or recorded photographically. (2) The Hoffman electrometer, an adaptation of the quadrant instrument in which a



Electrometer. Fig. 4. Vertical capillary Electrometer, left; simple quadrant type, right

large increase in sensitivity is secured by making the needle asymmetrical and substituting binants for quadrants. (3) The Lindemann electrometer, a compact instrument which can be actually mounted on a telescope, with which it is used in combination with a photo-electric cell for measurement of stellar intensity. It is similar in principle to a quadrant electrometer, but four cross-connected plates replace the quadrants and a needle is suspended centrally on a torsion wire.

Fig. 4 shows a simple type of quadrant electrometer, and also a vertical capillary electrometer. This latter depends for its action upon an increase in the surface tension where a column of mercury contacts dilute sulphuric acid, when an E.M.F. is applied.

Electron. One of the fundamental particles that constitute matter. It received its name in 1891 from Johnstone Stoney, who thought of it as the atom of electricity, i.e. the smallest quantity of electricity that can exist. An atom is thought to consist of a small positively charged centre or nucleus round which electrons circulate in orbits. The electron carries the smallest possible negative charge, while a proton (*q.v.*) carries the same charge with opposite sign. Thus if the nucleus contains n protons and m neutrons (*q.v.*), n electrons circulate round it; the atom is electrically neutral.

An electric current consists either of the transfer of electrons from atom to atom or movement of positive ions (atoms which have lost one electron). Cathode rays, obtained by an electrical discharge through a vacuum tube, consist of fast moving electrons: Sir Joseph Thomson proved these cathode rays to be particles, and his son, Sir George Thomson, showed them to have the properties of a wave motion such as light, e.g. to be able to form a diffraction pattern. This has led to the wave mechanical theory of matter which conceives of electrons and other particles as possessing in some way at the same time both particle and wave properties. This means that the picture of the atom given above is only approximate.

The mass of the proton (or hydrogen nucleus) is 1,840 times that of the electron and is virtually the same as that of the neutron. Thus the mass of an atom resides in the nucleus. A particle with the same mass as, but of opposite

(positive) charge to, the electron has been discovered in cosmic rays. It is called the positron, and should not be confused with the proton, which has the same charge but is 1,840 times as heavy. Electrons and positrons attract one another, and their combination causes mutual annihilation (i.e. they both vanish) and the production of a photon or γ -ray. See Electricity; Nuclear Fission.

Electron Compound. Term used in metallurgy to denote an intermetallic compound which does not conform to the normal laws of chemical valency, but has a similar ratio of valency electrons to atoms. Hume-Rothery in 1926 pointed out that alloys having the body-centred cubic structure have a valency electron/atom ratio of 3 to 2; thus CuZn has 3 valency electrons and 2 atoms, while Cu₃Al has 6 valency electrons and 4 atoms. Similarly the face-centred cubic structure has a ratio of 21 to 13 and the close-packed hexagonal a ratio of 7 to 4.

ELECTRONICS: CONTROL OF ELECTRONS

H. G. M. Spratt, B.Sc., A.M.I.E.E.

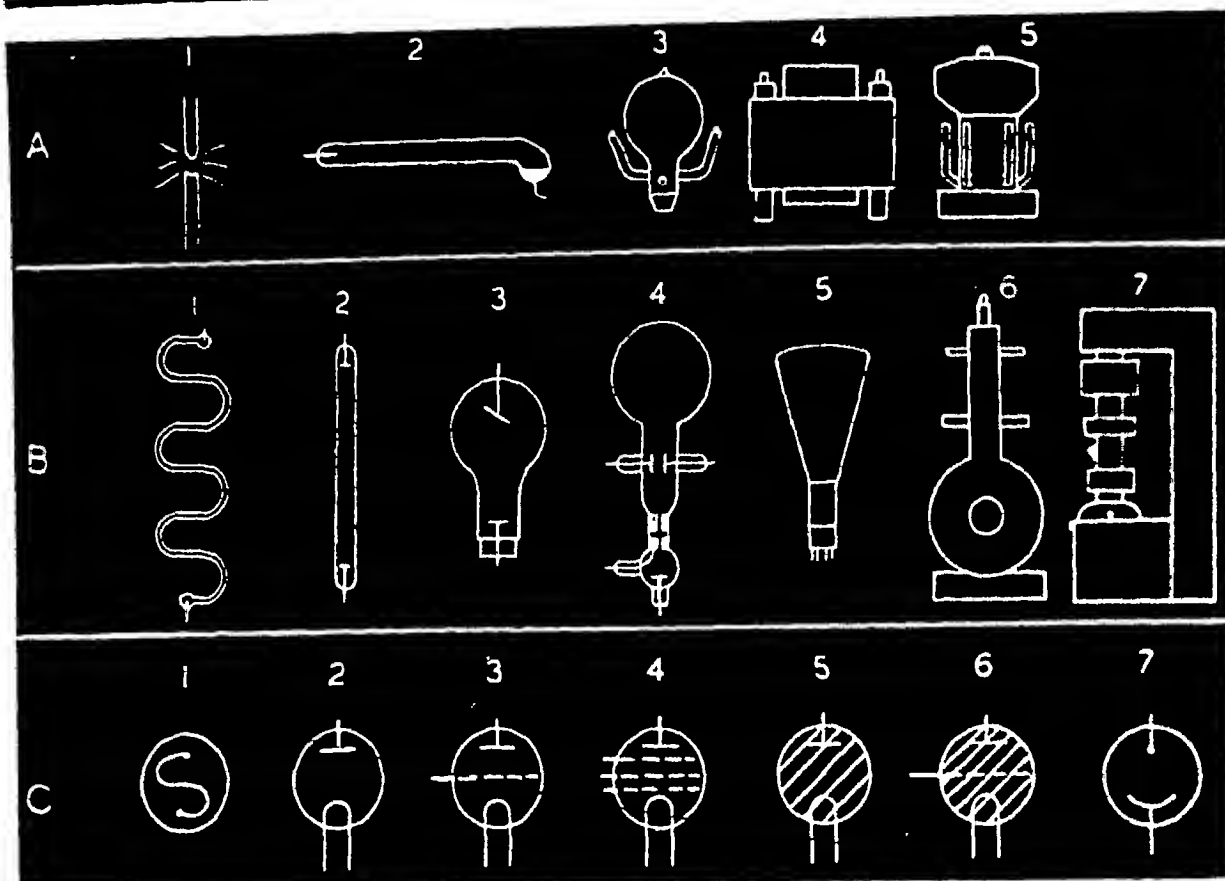
This expert article covers the basic principles of the applied physical science concerned with the development of electrical circuits using thermionic valves and other devices in which the motion of electrons is controlled. The chief applications of the science of electronics are dealt with and there are references to relevant entries elsewhere in this Encyclopedia. See also: Radar; Radio; Television; Thermionic Valve

The term Electronics deals with the behaviour, control, and practical uses of electrons in vacuo or in rarified gases. To a lesser extent, the term also covers the functioning and control of semi-conductors.

The electron, the smallest form of particle yet known, has a mass of 9.038×10^{-28} gm., and a negative charge of 1.590×10^{-19} coulomb. In general, it rotates round a proton to form an atom or part of one, but all conducting substances embody large numbers of free electrons moving with random velocities but normally within the body of the material. These free electrons can be emitted from metallic surfaces by thermionic or photo-electric means, or by secondary emission. At normal atmospheric pressures any electron emission is stopped or slowed down by immediate collision with gas molecules. In the practical application of electronics, therefore, emission takes place either in a hard vacuum or in certain gases at extremely low pressures. Moreover, an electron, being a negative electric charge, its emission is accelerated in any electric field towards the point of highest posi-

tive potential. Hence its velocity is generally expressed in eV (electron volts) or MeV (mega-electron volts), e.g. the velocity it would acquire when accelerated through the particular potential change. In the absence of an electric field, an emitted electron immediately returns to the source of its emission. Therefore to draw electrons away from an emitting surface (the cathode), a positive electrode or anode must be provided. A stream of electrons moving from cathode to anode constitutes an electric current, which is always unidirectional.

Thermionic emission from a cathode occurs when the cathode is heated sufficiently. The emission density depends upon the temperature, the material of the cathode, and, to some extent, upon the potential difference between cathode and anode. Of the virgin metals the best emitter is tungsten, but the best results are obtained from a metal alloy coated with one of the alkaline-earth metals, e.g. barium or strontium, and at a temperature of about 1000° K. Starting with a low anode voltage E , and assum-



Electronics. Symbols used in diagrams of electronic circuits. Row A. The electric arc: 1. Open arc; 2. Mercury vapour arc; 3. Modified design of No. 2 to serve as a rectifier; 4. Large continuously evacuated steel tank rectifier; 5. Pumpless steel tank rectifier. Row B. Discharge tube: 1. Geissler tube; 2. Moore tube, a predecessor of the fluorescent lamp; 3. Crookes' tube; 4. Thompson's cathode ray oscillograph; 5. Industrial form of C.R. tube with flattened end; 6. Large metal tube continuously evacuated model; 7. Electron microscope. Row C. Filament lamp: 1. Incandescent lamp; 2. Hot cathode diode valve; 3. Triode valve; 4. Pentode; 5. Gas-filled rectifier diode; 6. G.F. triode or thyatron; 7. Photo-electric cell

ing a hard vacuum, the electron current flowing to it will increase proportionally to $E^{1.5}$, but a point will be reached where the curve flattens out and the emission is then said to be saturated. This effect is due to the electrons in the anode-cathode space forming a negative space-charge which tends to repel those following. An increased anode potential draws across more and more electrons until at saturation all emitted electrons reach the anode. An electrode system, consisting simply of a cathode and an anode, is known as a diode (figs. 1 and 2). By inserting a third electrode or grid between cathode and anode as in fig. 3 and applying an increasing negative potential to it, the

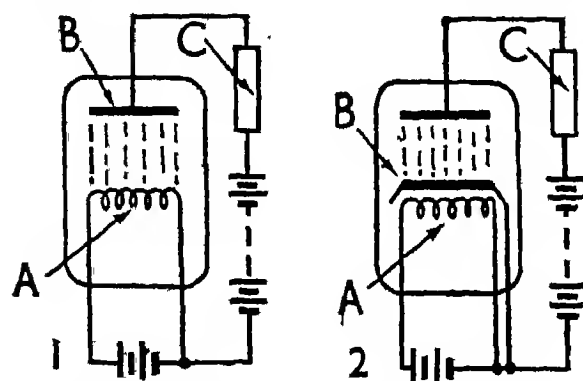


Fig. 1. Diode with directly-heated cathode: A, cathode; B, anode; C, load. Fig. 2. Diode with indirectly-heated cathode: A, heater; B, cathode; C, load

electron current can be reduced from saturation value down to zero. This arrangement constituted the common three-electrode valve or triode. The addition of further electrodes forms tetrodes, pentodes, etc. See Thermionic Valve.

Photo-electric emission takes place when certain light-sensitive substances are exposed to light, the most sensitive being caesium. As with thermionic emission, an anode is required to draw off the electrons and fig. 4 shows diagrammatically a photo-cell consisting of a photo-cathode in the form of a caesium film evaporated on to the inside of the glass wall and the anode in the form of a plate. When light is focused on to the cathode, electrons are emitted from it and flow to the positive anode at a rate proportional to the intensity of the light and the p.d. between the electrodes.

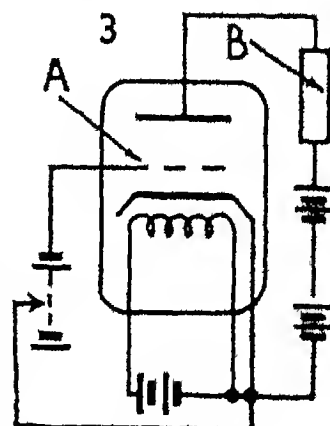


Fig. 3. Triode: A, grid; B, load

Secondary emission occurs from most metals and certain other substances when struck by fast moving electrons (primary electrons). The number of secondary electrons released by one primary depends upon the primary velocity, and the nature and surface of the material. With caesium the figure can be as high as 8. The optimum primary velocity is about 1000V. By providing a succession of emitting surfaces and directing the path of the electrons from one to another, a total multiplication factor of over 100,000 can be obtained. A combination of photo-electric and secondary emis-

sion is shown in the photo-multiplier tube (fig. 5).

Electrons tend to travel in a direction normal to the equipotential lines of electric force, but where a number are concerned the mutual repulsive force between individual electrons causes them to diverge. A suitable arrangement of metal cylinders, through which the beam passes and to which suitable potentials are applied, will produce a field configuration causing the electrons to converge at some point

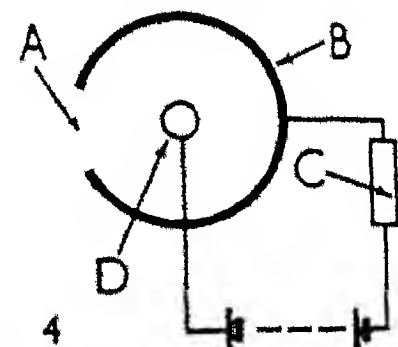


Fig. 4. Photo cell: A, window for light entry; along the B, internal caesium coating; C, load; D, positive anode

as indicated in fig. 6, opposite. Since a stream of electrons constitutes an electric current, it can be controlled similarly by a magnetic field, although here the accelerating force is in a direction perpendicular to both the

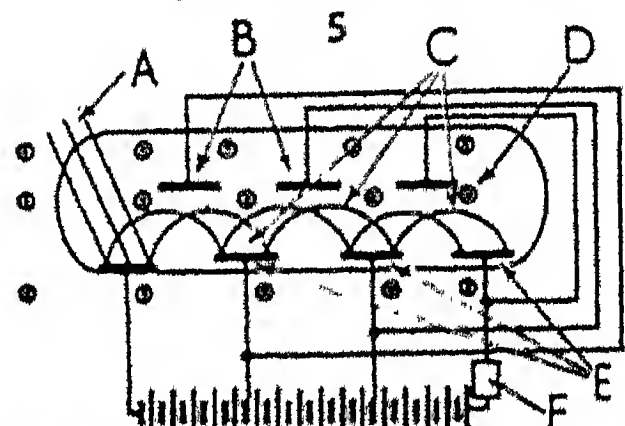


Fig. 5. Photo-multiplier tube: A, light beam; B, deflecting plates; C, electron paths; D, transverse magnetic field; E, electron multiplier plates; F, load

direction of electron movement and that of the magnetic field. The magnetic field produced by a current flowing in a coil surrounding the beam, as in fig. 7, opposite, is of the correct conformation for focusing the beam. A coil of this type can be designed to produce a parallel rather than a converging beam.

Both electric and magnetic fields can be used to deflect an electron beam as a whole. Fig. 8, opposite, shows two pairs of flat-plate electrodes arranged in a cathode ray tube to deflect the beam in any direction. Fig. 9, opposite, illustrates in cross-section how a similar beam deflection is effected by a pair of simple magnetic circuits. Focusing and deflection are essential in cathode ray tubes and many other electronic devices.

There are several variations of the foregoing basic forms of electron control. One type of multiplier tube produces the multiplying effect by oscillating the electrons

backwards and forwards between two electrodes across which is applied a high alternating voltage. In magnetrons (*q.v.*), electrons accelerated from a central cathode to a surrounding anode are deflected from a radial into a spiral path by an external magnetic field (see fig. 10). In klystrons

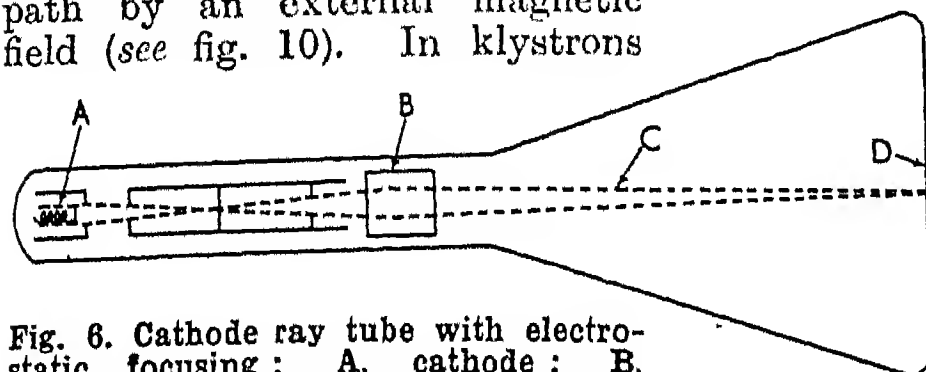


Fig. 6. Cathode ray tube with electrostatic focusing: A, cathode; B, cylindrical focusing lens; C, electron beam; D, screen

(*q.v.*), the electrons are bunched along a beam by an oscillating resonant cavity through which the beam passes.

The property of phosphor substances to fluoresce (emit light) when struck by electrons is the basis of the cathode ray tube and many other electronic devices. In fig. 11, p. 3012, an electron beam is focused on to the glass wall at the right-hand end of the cathode ray tube. This end, which is called the screen, is coated internally with a suitable phosphor, e.g. zinc cadmium sulphide. When observed externally, a bright spot appears on the screen if the electron beam is stationary, and a pattern if it is moving under the influence of the deflecting fields. The strength of the beam can be controlled from full intensity to zero by the in-

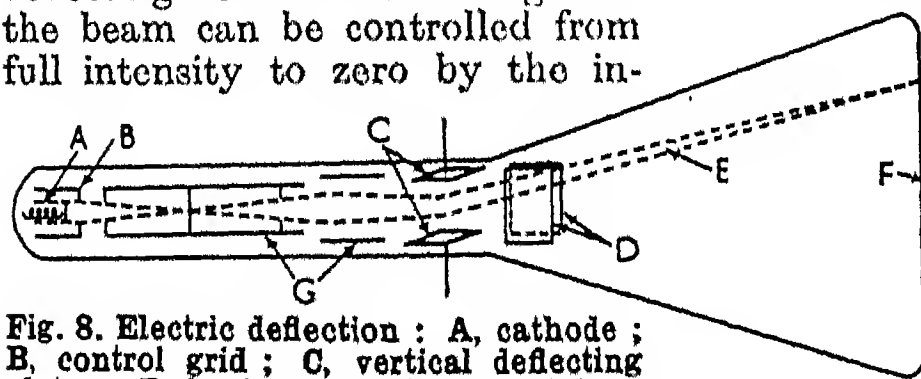


Fig. 8. Electric deflection: A, cathode; B, control grid; C, vertical deflecting plates; D, horizontal deflecting plates; E, deflected beam; F, screen; G, focusing electrodes

clusion of a grid. This particularly applies to cathode ray tubes where control of beam current governs fluorescent intensity.

If a low-pressure gas is substituted for the hard vacuum in a diode, emitted electrons immediately come into contact with gas molecules. As a result, these molecules become ionized (lose electrons and become positively charged) thereby annulling the negative space charge. At the same time, electrons released from the molecules will sometimes attract to themselves neutral molecules which thus become negative ions. At quite low voltages, e.g. 10-15 volts, the current will suddenly rise to

its full value and any additional voltage will produce a negligible current increase. A third electrode can be introduced into the tube but its power of control will be limited to switching on. Once current flow has started, only reduction of the anode potential will stop it. Because of the ionization, these tubes, called thyratrons, exhibit a characteristic glow, the colour depending upon the nature of the

gas. The same effect occurs if the tubes embody two electrodes only and have unheated cathodes, but now the current flow is lower and the striking voltage never less than 60 volts, a typical characteristic being shown in fig. 12, p. 3012. These gas discharge tubes (*q.v.*), as they are called, are used

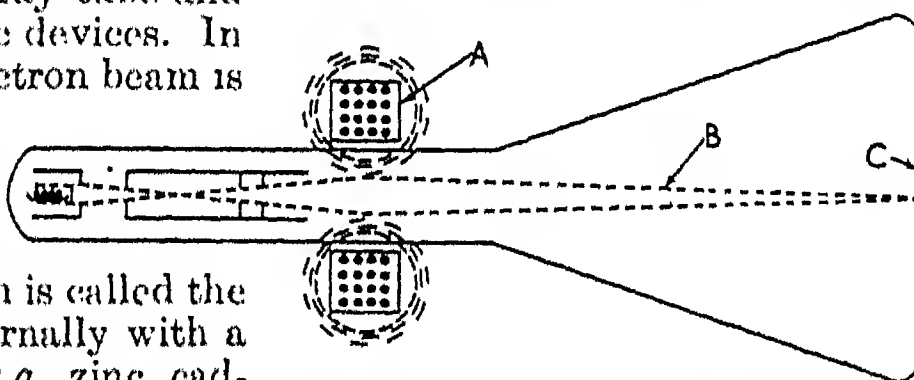


Fig. 7. Cathode ray tube with magnetic focusing: A, magnetic focusing coil; B, electron beam; C, screen

for illumination and for voltage regulating and counting.

When the speed of electrons and positive ions is greatly accelerated by the application of 50,000 volts and upwards, and then allowed to strike a metal target, X-rays are emitted. Fig. 13, p. 3012, illustrates a low-voltage X-ray tube which has a heated filament as the emitting cathode and a solid tungsten rod as the target or anticathode. X-rays are analogous to light rays but of much shorter wave length and higher penetrating power. They are used for therapeutic purposes, and as bombarding sources in atomic physics. (See also X-rays and X-ray Equipment; Linear Accelerator.)

X-rays ionize gases through which they pass, so creating positive and negative ions. If a partially evacuated glass chamber

is provided with positive and negative electrodes, X-ray bombardment will cause positive ions to pass to the negative electrode and negative ions to the positive electrode. This constitutes either an electric current which can be measured or a succession of elec-

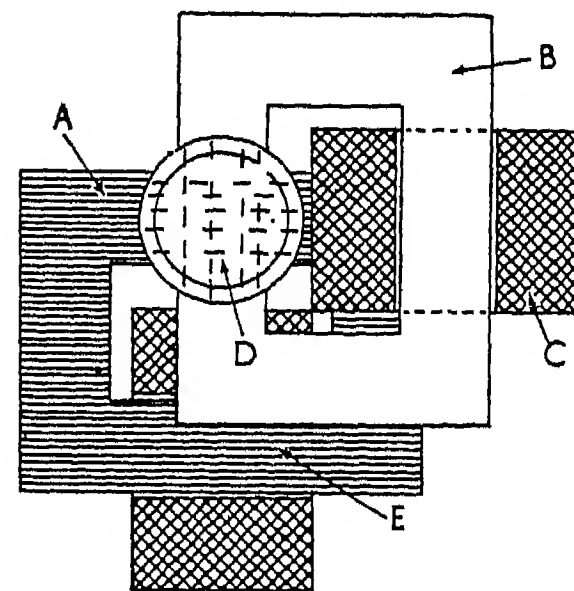


Fig. 9. Cross-section of cathode ray tube: A, iron core of vertical deflector; B, iron core of horizontal deflector; C, magnetising coil of horizontal deflector; D, tube; E, magnetising coil of vertical deflector

tronic charges which can be counted. Both provide measures of the X-ray intensity. X-rays also cause phosphors to fluoresce and this effect can be used to measure intensity. By virtue of their wave nature, X-rays can be used for investigating crystal structure.

Semi-conductors are substances the conductivity properties of which are between those of conductors and insulators. All are characterised by not obeying Ohm's law, either because they have an extremely high negative temperature coefficient, that is, their resistivity falls rapidly with increasing temperature, or because they are unidirectional conductors. Under the first head come thermistors; under the second, crystals, diodes, and transistors. Photo-conducting cells are also semi-conductors.

The anomalous behaviour of semi-conductors is due to their structure not having the large number of free electrons that

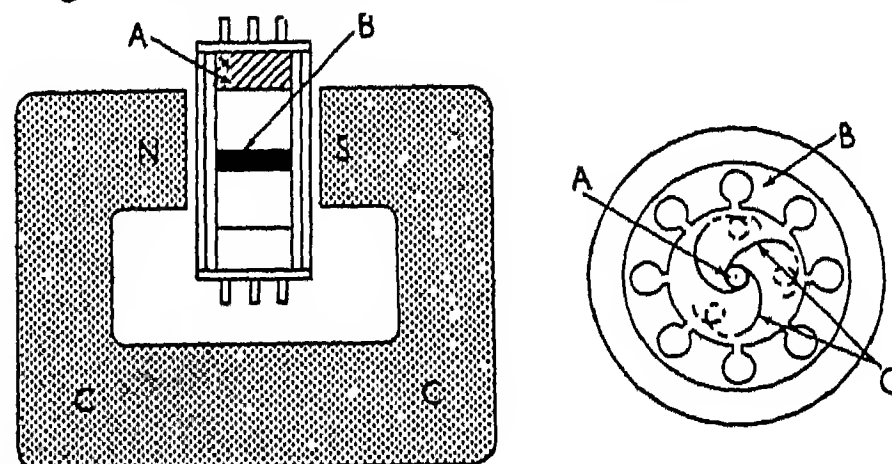


Fig. 10. Cavity magnetron: Left: A, anode; B, cathode; C, permanent magnet. Right: plan view: A, anode; B, cathode; C, trajectory of electrons

exists in true conductors. On the other hand, the electrons of the atomic structures of semi-conductors are not so rigidly bound

to them as in the atoms of insulators. Electrons can in practice be detached from their atoms either as a result of impurities present in the form of trace elements, *e.g.* arsenic in germanium transistors,

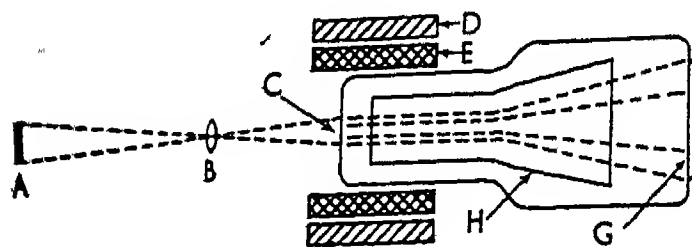


Fig. 11. Image converter: A, object; B, optical lens; C, photo-cathode; D, deflecting coils; E, focusing coil; F, camera; G, screen; H, grid

or by the effect of heat or light. Whatever the cause, the result is either a restricted number of excess electrons or a deficit of electrons, or "holes" as they are called. Excess of electrons produces a negative charge which will flow towards a positive electrode while the holes give rise to a positive charge which will move towards a negative electrode. These conditions are known as "n-type" and "p-type" respectively. Both effects are self-sustaining, that is, if electrons or holes are drawn off by the provision of electrodes and suitable potentials, fresh electrons or holes are automatically formed in the semi-conductor and

current continues to flow. One form of transistor, which can be described as an amplifying crystal, operates by virtue of modulation of the current flow between two electrodes by the action of a third (contact type). In the junction

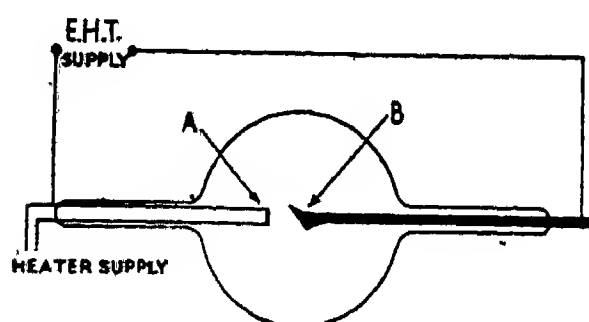


Fig. 13. Low-voltage X-ray tube; A, cathode; B, anode

type of transistor, the amplifying action takes place as a result of p-type and n-type junctions deliberately formed on opposite sides of the crystal.

The simplest electronic device is the two-electrode (diode) valve from which have been developed thermionic valves (*q.v.*), incorporating as many as eight electrodes. These valves which are unsuited to frequencies exceeding 1,000 Mc/s, are used for amplifying, oscillating, mixing and switching

purposes. Valves in the centimetric range include the magnetron, the klystron, and the travelling-wave tube, which operate by extracting energy from a steady, unidirectional electron stream.

Cathode ray tubes are electronic components in which a focused and deflected beam of electrons strikes a fluorescent screen, tracing a visible pattern on it. They are used as measurement tubes, television screens, projection tubes, flying-spot scanners (see Television) and the plan-position indicator tubes, used in radar navigational equipment. Special types of cathode ray tubes are incorporated in computers for storing information during calculations.

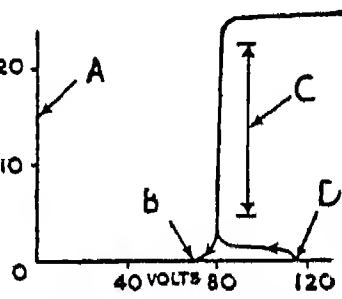


Fig. 12. Voltage-current of neon tube; A, current; B, extinction voltage; C, regulation range; D, striking voltage

The electron microscope is based on the principle of electron-beam focusing.

The ability of specially shaped magnetic lenses to project a parallel beam of electrons from a cathode of substantial size made possible the image intensifier (fig. 14). The device is used for brightening faint radio graphs in X-ray exposures. The fluorescent screen, which, by itself, might yield an almost invisible image, is backed by a photo-sensitive cathode. Electrons accelerated from it by a high voltage bombard a second fluorescent screen and produce an image of the first intensified by up to 1,000 times.

There are a number of varieties of the emissive-type photo-cell which is one of the most common electronic devices with industrial applications. The cathode surface material of the cell can be selected to suit the character of the light to which the cell will be exposed, *e.g.* caesium-silveroxide for the orange-red end of the spectrum and caesium-antimony for the blue end. All types take the form of a glass envelope, which is either

completely evacuated or gas-filled. The gas-filled type is more sensitive, but the vacuum photo-cell has greater stability and will respond to higher frequencies if the light is fluctuating.

Gas-filled thermionic valves embody several important groups of electronic devices. They include thyratrons (fig. 15), *i.e.* three or four-electrode valves with mercury-vapour, rare-gas or hydrogen filling. Because of their unique switching properties, reliability—following strict attention to circuit design—and low loading effects,

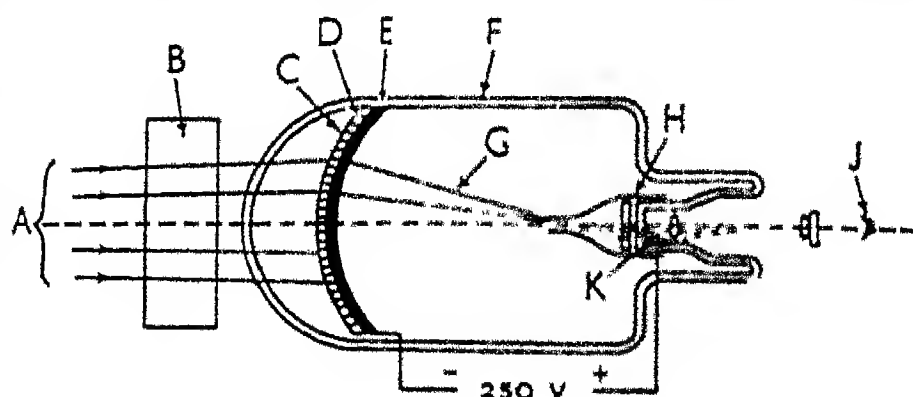


Fig. 14. Image intensifier. A X-rays; B, phantom; C, screen carrier; D, screen; E, photo-cathode; F, glass envelope; G, photo-electrons; H, viewing screen; J, observer's eye; K, light

they are favoured for motor speed control, welding control, and several other regulating purposes. The cold-cathode group constitutes a similar group. First comes the simple neon tube which can be used for illuminating, stroboscopic purposes, or providing a reference voltage, or as a stabilizer or a sawtooth generator. More elaborate forms of neon tubes act as digital counter tubes (fig. 18, p. 3013). In this group are also included the gas filled dis-



Fig. 15. Typical thyratrons made by Mullard Ltd., for use in various types of electronic device

charge tubes, such as the sodium and the daylight lamp (see fig. 17, p. 3013), and the flash tube, which gives short but very intense light flashes for high-speed photography. Many of the radio-

tion-measuring tubes (Fig. 18) consist of glass envelopes, or metal envelopes with glass windows, filled with low-pressure gas and provided with electrodes. They are used in

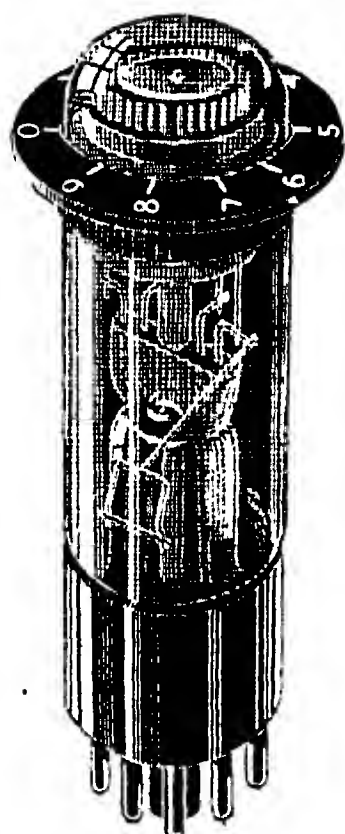


Fig. 16. Ericson tube with plate in position

atomic power stations and research centres to measure the intensity of radiation in any particular spot by virtue of the rate of ionisation of the gas within them. They are also used to measure the intensity of X-ray irradiation.

X-ray tubes have application in medicine for examining the interior of the human body, and in industry for detecting flaws in metals and other materials and components. The linear accelerator, the cyclotron, and the betatron, which are used in nuclear fission

e.g. the lead sulphide cell, are particularly sensitive to infra-red radiation. The two most commonly used materials for crystal diodes are silicon and germanium. These diodes, because of their small size, are characterized by very short transit time and low capacitance, and are particularly suitable for use in microwave equipment. Transistors (*q.v.*) are three-electrode silicon or germanium crystals which have amplifying properties. They are smaller than the smallest valve and require as low as one-tenth the power supply.

Electron Microscope. The electronic equivalent of the light microscope, the comparison between the two optical systems being illustrated in fig. 1, where a typical electron instrument is shown on the left, and a light microscope projecting its magnified image downwards on the right. Three lenses are required in any microscope: a condenser to concentrate the illumination upon the object, an objective to give an enlarged image of the latter, and an eyepiece or projecting lens to produce a further enlargement of part of the first image.

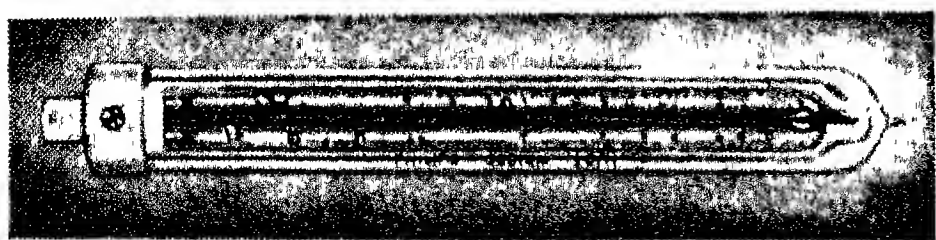


Fig. 17. Philips sodium lamp

and other atomic energy processes to produce high-velocity particles depend upon electronic principles for their functioning.

Semi-conductors are an important category of electron devices, and include thermistors, photo-conducting cells, crystal diodes and transistors. Thermistors are non-linear resistors, formed of certain metallic oxides, the resistance of which falls rapidly with increasing internal temperature induced by increasing current. They are

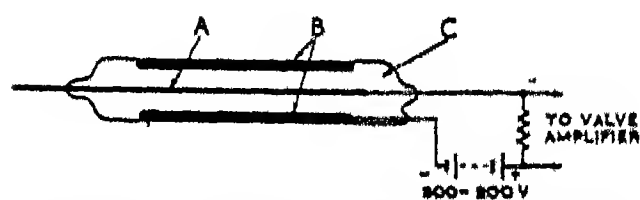
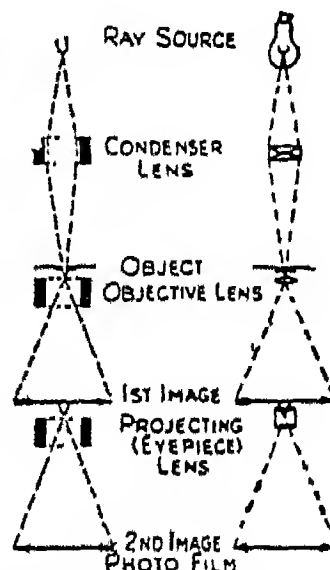


Fig. 18. Geiger counter tube. A, anode; B, cathode; C, mercury vapour

used for temperature measurement and control, power measurement, and other purposes. Photo-conducting cells (*see* photo-cells) are generally made from the sulphides, selenides or tellurides of various elements. Some of these,

The process of image formation by the lenses of an electron microscope is basically analogous with that by the lenses of the light microscope, although the contrasts in the images are produced in completely different ways. The shades in the light image are due to increased absorption of the light in thicker or less transparent parts of the object. Conversely, the shades in the image in an electron microscope are the result of increased electron scattering in thicker parts of the object or in parts containing heavier atoms. By scattering, however, the particular rays are not stopped in the object, but are merely deflected into larger angles and so removed from those that enter the image-projecting part of the objective. In an electron microscope, instead of the lamp or daylight in the light microscope, a hot cathode discharge



Electron Microscope. Fig. 1. Optical systems of electron (left) and light (right) microscopes

tube working at 50,000 volts is used; instead of glass lenses, three iron-cored solenoids; and a fluorescent screen, instead of the retina of the human eye or a ground-glass screen, receives the final image. An example is shown in fig. 2.

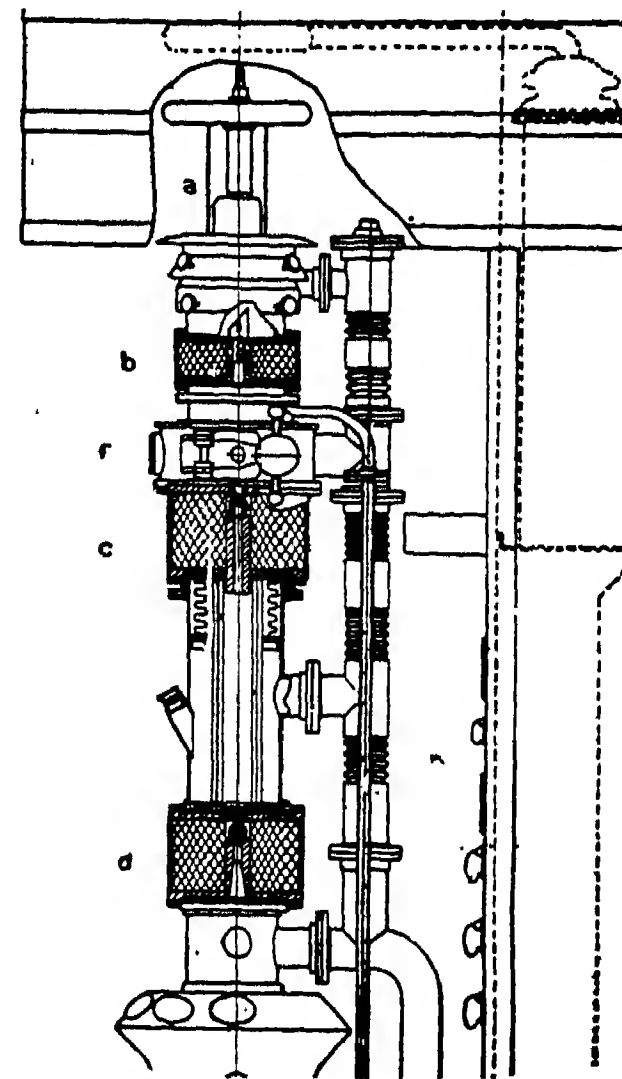


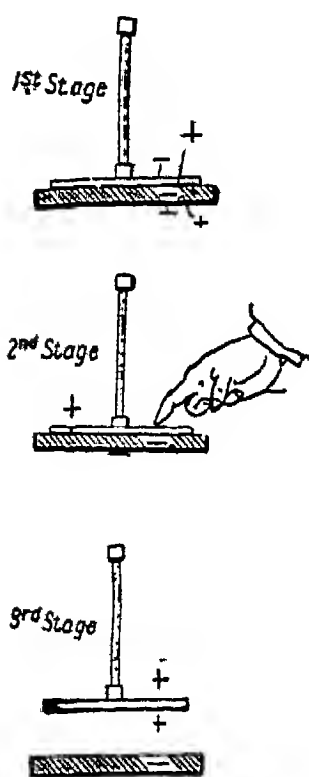
Fig. 2. Diagram showing cross section of R.C.A. electron microscope showing electron discharge tube at a; the lenses at b, c and d; air lock for inserting specimens at f; control and meter panel at k, and viewing ports for fluorescent screen at base

The useful magnification which can be given by the electron microscope is about 100,000 times as compared with 1,000 times for the light microscope. The reason for this is that details cannot be distinguished which are smaller than half the wave-length of the illuminant, and visible light reaches the limit at 1,000 magnifications. As the wavelength of the electron beam employed is about 10^{-5} that of light, an improvement of 10^5 times is in theory possible.

Electrophorus. Simple electrostatic machine or generator of electricity. It was invented by the Italian scientist Alessandro Volta in 1775, and consists of a metal dish called the sole-plate; a layer of some good non-conducting substance, such as resin, glass, india-rubber, ebonite, or pitch; a metal disk, called the cover, rather smaller than the sole-plate; and an insulated rod attached to the disk and serving as a handle by which it can be lifted.

In using the apparatus the parts are usually first warmed to ensure that they are dry, and the resin base is then struck or rubbed

with a piece of cat's-skin or other fur, or a piece of dry woollen cloth, and is thus electrically excited,



Electrophorus, the simplest electricity maker. For explanation see text

the charge of electricity developed upon it being negative. The metal upper plate is then placed on the resin base; it does not, however, receive from the resin any direct charge of electricity, but by induction develops a charge of positive electricity on the surface of the disk where it is in contact with the resin, and a charge of negative electricity on the upper surface of the disk, as shown in the sectional illustration. If now the upper surface of the disk be touched with a finger and thus put into electrical contact with the earth, the negative charge of the disk will pass to earth leaving the disk positively electrified throughout; and if lifted away from the resin the disk will give a spark if the knuckle or any conductor be brought near it.

The sole-plate performs an important function by the mutual induction which takes place between it and the upper plate or cover. When the latter develops its positive charge on being put in contact with the earth, the sole-plate receives a corresponding negative charge from the earth, and in this way the original positive charge of the cover due to the negative charge of the resin base may become an appreciable amount. Providing insulation is good the electrophorus may be worked almost indefinitely, i.e. every time the cover is put back on the base and its surface touched with the finger the action takes place and a spark may be obtained when the cover is lifted.

Electro-Plating. The deposition of a metal on another substance, usually another metal, by electro-chemical action, either for the purpose of protecting the latter metal from corrosion, as when iron is electro-plated with copper, or for the purpose of giving to a comparatively cheap metal the appearance and some of the properties of one more costly, as

when a teapot of base metal is plated with silver.

The scientific principle upon which the art is immediately based is described under Electrolysis. The operation can be carried out on a domestic scale with small and simple apparatus; but when carried out on a commercial scale a large vat or bath is used, constructed usually of stout wood lined with lead or slate, though sometimes asphalt or cement is used, or the vat may be built of enamelled iron. It is usually rectangular in shape, and is fitted with a flange round the top, to which are attached two rectangles made of brass tubing, one being a little larger all round and fixed a little higher than the other, as shown in the illustration. The rectangles, and the vat itself, are insulated both from one another and from the earth.

Composition of the Bath

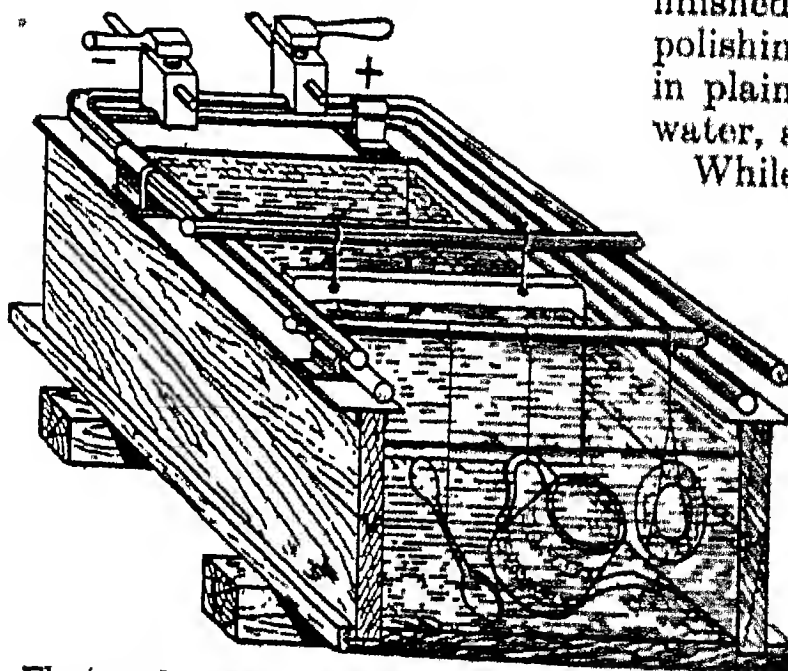
The outer ring is used to take the current into the vat, and is known as the anode ring; the current passes out through the other rectangle, the cathode ring. The bath is filled with a solution which varies according to the nature of the work to be done. Electric current is furnished by a dynamo which gives a large current at low voltage. The articles to be plated, when of convenient size, are suspended in the solution by means of wires from crossbars resting on the cathode ring; while plates of the metal which is to be deposited on the articles are suspended from similar bars resting on the outer or anode ring. The arrangement enables many articles to be placed in one vat together with an appropriate number of anode plates, which may be disposed along the brass rectangle as most convenient.

A simple example will serve to illustrate the entire process, whatever the metal that is to be deposited. Suppose that a teapot of

pewter or other alloy is to be plated with silver. The teapot is first highly polished by rotating "bobs" covered with felt and carrying an abrasive compound, and then by "mops" of linen. It is made chemically clean, by hand scouring, or caustic potash or soda, or pickling in acid, followed by hot water swills; it may be "degreased" by a solvent such as petrol or trichlorethylene. An operation known as "quicking" sometimes follows; the teapot is dipped in a solution of cyanide of mercury which forms a thin deposit of mercury on the surface, this facilitating the silver deposit and giving better adhesion. The teapot is suspended in the vat from one of the crossbars of the cathode ring, as shown in the figure. The solution is prepared from cyanide of potassium and cyanide of silver precipitated from nitrate of silver, in water. It contains 1½-3 oz. of silver to the gallon.

The anode plate is of commercially pure silver; it is, of course, connected with the positive terminal of the dynamo or battery. When the current passes, the silver in the bath is thrown out of solution and deposited on the teapot, while at the same time an equal amount of silver is dissolved off the anode plate, and, entering into solution in the bath, takes the place of that deposited on the teapot. The process goes on so long as the current is maintained, until the anode is entirely dissolved or until as much silver has been deposited on the teapot as desired. The time occupied ranges from two to twelve hours or longer. The amount actually deposited on such an article as a teapot is about 1½ oz. per sq. ft. of surface covered, the thickness of ordinary writing paper. The teapot, as it leaves the bath, has a fine granular-looking surface of chalky whiteness. The smooth, bright surface of the finished article is given by further polishing after a thorough washing in plain water, dipping in boiling water, and drying in hot sawdust.

While silver is frequently used for table-ware, etc., copper, nickel, and chromium are in common use for decorative work. Cadmium, replacing nickel, is frequently used unpolished for anti-rust protection of steel screws. Zinc, tin, and lead are electro-plated for protective purposes. Palladium and rhodium will



Electro-plating. Diagram showing how articles are electro-plated with silver

provide an untarnishable skin on silver. All these processes are similar in principle to that already described for silver. Often the desired result cannot satisfactorily be obtained directly without a preliminary plating of another metal. Steel before nickel-plating frequently receives a first coat of copper. Chromium is usually deposited over nickel.

Electro-plating is a complex art, and many different methods and baths are in use. Improving technique constantly enhances the quality and adhesion of a deposit; the speed of deposition; the reduction of expense; and the omission of preliminary coats of other metals. Much work is carried out automatically, the parts to be plated being loaded on to a moving conveyor, which carries them down a line of tanks containing the various cleaning solutions; the actual plating bath, and hot and cold water swills. The time spent in each bath is automatically controlled, and little supervision is required except for loading and unloading.

Electro-Positive. In electricity, positive usually refers to the source of current flow, or point of higher potential. See Electro-Negative.

Electroscope. Term given to an instrument for determining whether a body is electrified or not, and if so, the character of the electrification, whether positive or negative. In its simplest form it consists of two small balls of pith suspended by silk threads from the arm of a metal stand, as shown below. An almost equally simple form is represented by the balanced needle, similar to the needle of a mariner's compass, devised by Dr. Gilbert of Colchester in 1600.

The electroscope usually consists of a glass bell jar commonly fitted with a brass ring round the bottom or fitted to a wooden base so as to be easily removable. The jar has a stopper of ebonite in which is fitted a stout brass wire with a removable plate or ball at the top, and from the bottom of which two strips of gold or

aluminium leaf depend. Opposite each strip and within reach of its end is a strip of tin foil attached to the interior surface of the jar. A glass rod, electrically excited by having been rubbed, if brought near the instrument will cause the leaves to repel one another; in favourable conditions so sensitive is the instrument that the leaves will begin to move apart while the glass rod is several feet away. What happens is that the electricity on the rod attracts the opposite kind into the plate or knob of the electroscope and repels the same kind into the leaves, which fly apart in accordance with the well-known law that like electricities repel and unlike attract.

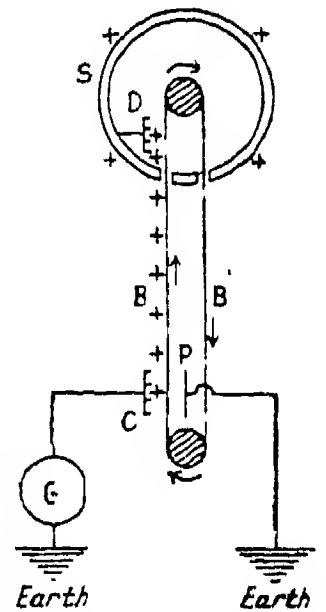
In determining the particular kind of electricity on an object, the electroscope is first charged by touching the knob or plate with a glass rod that has been rubbed with silk, which causes the leaves to diverge under the influence of positive electricity. If then the body whose character

is to be determined be brought near the plate and the leaves diverge still farther, the body is electrified positively; if the leaves close, it has a negative charge. The strips of foil on the sides of the jar prevent the leaves from being damaged by the violence with which they are repelled or from adhering to the sides of the jar. The instant the leaves touch the foil they lose their charge to the earth, and fall back into their normal positions.

Whereas the electroscope is used to determine whether a body is electrified and the kind of electricity with which it is charged, a more developed instrument to measure potential difference is the electrometer (*q.v.*).

Electrostatic Machine. Machine for the conversion of mechanical work into electric energy. There are two kinds, frictional and influence machines. Ramsden's plate electrical machine belongs to the former class, and Wimshurst's well-known apparatus to the latter. Machines to produce two million volts or more have been designed by van der Graaff and others. They consist essentially (see illus.)

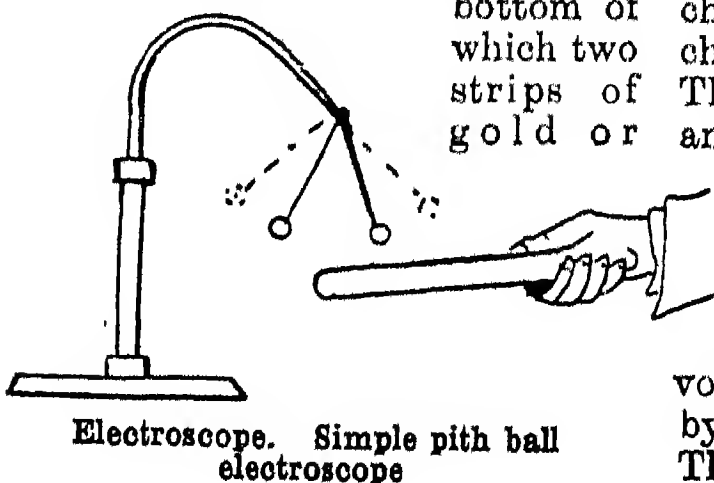
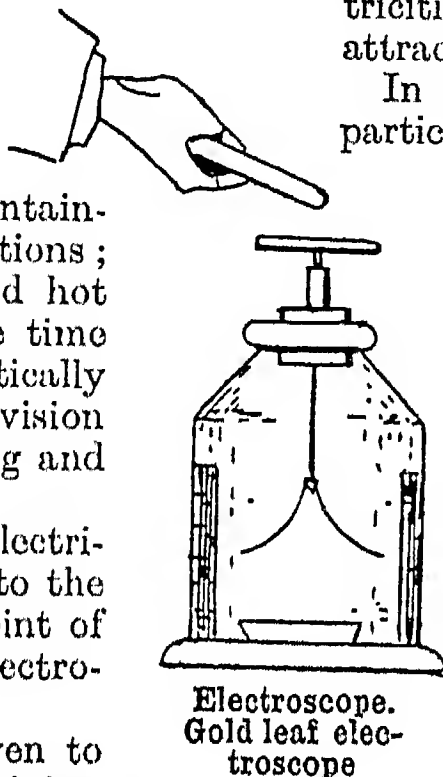
of a belt BB of insulating material upon which charges are sprayed by means of a "comb" C, which is connected to a unidirectional potential difference of 20,000 volts provided by the generator G. The charges are carried up by the moving belt BB into the inside of a hollow conducting but insulated sphere S, which collects the charge through the action of the collecting comb D. P is an earthed metal plate.



Electrostatic Machine. Diagram of a Van der Graaff generator. The lettering is explained in the text

Electrostatics. Term applied to that branch of the science of electricity which is concerned with electricity at rest or with electric charges, and is particularly occupied with the measurement of such charges. The science deals alike with the most elementary facts of electricity such as the phenomena exhibited by a rubbed glass rod, and with the profound problems associated with the electrical relations of atomic particles.

Electrotherapy. The treatment of diseased conditions by the application of electricity and, in a wider content, the use of electrical instruments in surgery and medicine. The first treatise on electrotherapy was published by Luigi Galvani in 1791, and the much abused treatments which were evolved in the next hundred years by the application of direct current to the body are called galvanism. Faradic current produced by a simple form of induction coil was also used at an early date. In 1890 it was shown that if the human body was traversed by a high-tension current reversing its direction more than 10,000 times per second no contraction of muscles resulted. D'Arsonval in Paris demonstrated in 1898 that high-frequency currents could modify some of the physiological processes of the body, and proved their power to increase the output of heat, the respiratory exchanges, and dilatation of blood vessels. The application of this through heating was called diathermy, and it was introduced into England in 1909 when a machine was installed in St. Bartholomew's Hospital. During the next ten years the advantages of diathermy both



in medicine and surgery were realised, and its use became general in countries with up-to-date medical practice.

Electrotherapy can be described under four headings :

(1) The application of heat, infra-red rays, and ultra-violet rays by means of lamps. This is expensive and probably less effective than hot water or wax baths. Ultra-violet rays are of value in certain skin diseases, but are more commonly used for their general tonic effect.

(2) Short-wave diathermy, efficient in heating deeper structures ; it should not be used for increasing surface circulation, but may be of considerable value in treating certain injuries such as sprains. Its use in a variety of other conditions, from high blood pressure to heart disease, is of doubtful value. In surgery it is used for the destruction of diseased tissue and new growths. Their destruction is brought about by the heat that is developed in the diseased tissues when the diathermy current passes through them, their temperature being raised to a degree sufficient to coagulate the tissues.

(3) Galvanic and Faradic currents, used in the treatment of certain nerve diseases to stimulate muscles. They are particularly useful where muscles are paralysed and cannot be contracted voluntarily. The method of treatment requires specialised knowledge and is prolonged.

(4) X-ray application. This is used in the treatment of cancer, and as a routine following operations for cancer to kill off any cancer cells which may possibly still remain. It is also of value in certain skin diseases such as fungus infections and chronic eczemas.

Equipment Available

Equipment for electrotherapy heat treatment consists of a mains-driven valve oscillator operating within a frequency range of 1-50 megacycles and providing power up to 600 watts or above. The high-tension supply for the valve may be rectified and smoothed alternating current, but more often main alternating current is used. The power output is usually adjustable by variation of the grid bias voltage and the patient's body, which forms the circuit, is either inductively coupled to the oscillator or isolated from it by means of capacitors. Heating is effected by means of either electromagnetic induction or an electrostatic field.

With electromagnetic induction, the r.f. current is passed through a flexible insulated cable, a few turns of which are wound

round the part of the body to be heated. Under these conditions, heating takes place through the creation of eddy currents and is at a maximum in the tissue with the highest electrical conductivity.

Heating by means of an electrostatic field is effected by insulated electrode pads which are applied to the appropriate part of the body so as to form a low-resistance capacitor with the body acting as the dielectric. Here, heating occurs as a result of the flow of current between the electrodes and again is dependent upon the conductivity of the body tissue.

The principal electrical instrument used in surgery is the electrocautery, sometimes called the electric knife. The equipment consists of two electrodes connected to an electrical power source. One electrode is in the form of a relatively wide pad which is applied to the body surface while the other is a metal probe with an insulated handle. The probe acts as a surgical knife, cutting the tissue through the concentration of heat and at the same time sealing the blood vessels.

Electricity is also used to illuminate certain cavities of the body, such as the lower bowel and the bronchi. Minute filament lamps are fixed to delicate instruments with a complicated arrangement of mirrors, so allowing the examination by the surgeon of the interior parts of the body.

Electric needles are used for destroying the root of superfluous or disfiguring hair and, occasionally, for removing warts and moles. Electromagnets are used for removing particles of metal from the eye.

Electrotyping. Particular form of electro-deposition. It differs from electro-plating in that the metal deposited does not become an intrinsic portion of the article on which it is laid, but is removed after it has been deposited; its object is to make a copy of a surface. It is used for making reproductions of coins and medals and works of art, and for preparing electrotypes for printing, both from type matter and from engraved surfaces in wood or metal. Fine half-tone blocks for illustrations are duplicated in this way.

If a reproduction of a medal is required, and the original is not too valuable to be risked in the depositing solution, it can be used as the cathode of the operation. It is prepared by having a wire twisted round its edge, leaving sufficient length for attaching to

the terminal of the electric battery or machine. The face which is not to be copied is embedded in gutta-percha; the face to be reproduced is slightly greased with olive oil by a fine-hair brush, to prevent a too powerful adhesion of the deposited metal, after which the medal is ready for the bath.

The solution is prepared according to the metal to be deposited, usually copper; after 12-24 hours the deposit will have acquired the necessary thickness, probably about 0.015 in., and the medal will be removed from the bath, when the electrotype can be detached. If now a mould be taken of this electrotype, and then another electrotype taken off that mould, the second electrotype will be a duplicate of the face of the original medal. A duplicate of the other face of the medal being obtained, the two halves can be soldered together, making a complete reproduction of the original.

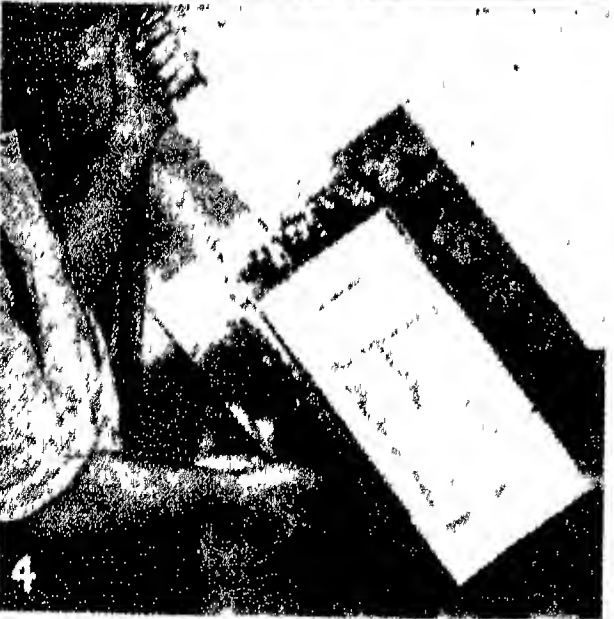
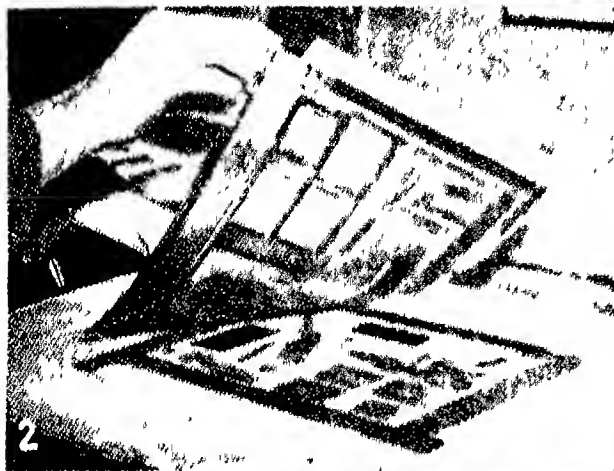
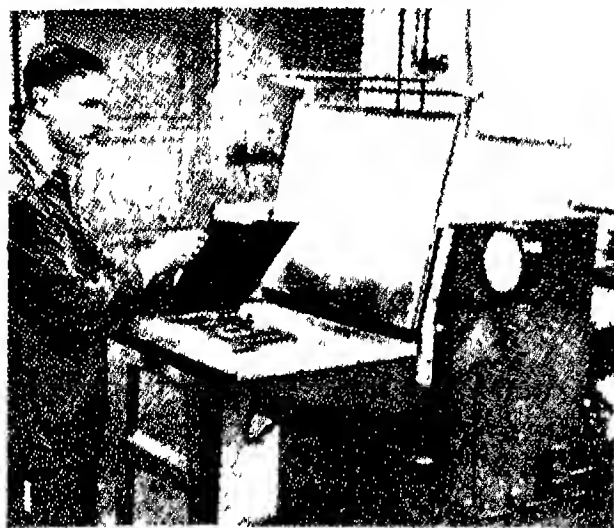
If the original coin or medal is too precious to be risked in the electrotype bath a plaster cast will be prepared, or a mould in gutta-percha by the aid of pressure.

Electrotyping from Type

A somewhat similar method is used for making electrotypes from printers' blocks and formes of type. One system uses a wax mould of the matter to be electrotyped. The mould is coated with graphite and has embedded in it a copper wire to increase the conductivity of the mould when in the bath, the wire being connected with the terminal of the vat, in which the mould becomes the cathode.

The anode is a plate of copper and the solution is acidified copper sulphate. A powerful current is used to secure the necessary thickness in the shortest possible time. The wax bed is then melted off in hot water and the electrotype is laid face down on an iron plate, heated, surrounded by a frame of iron bars; and molten "backing" metal, consisting of lead hardened with a little antimony and tin, is poured over it to a depth of from $\frac{1}{4}$ to $\frac{3}{8}$ in.

Another method is to make a mould from lead, the matter to be electrotyped being pressed into the lead under pressure. Although electrotypes made from wax and lead give very high accuracy in relation to the originals, they need elaborate plant and only one shell can be made from each mould. Almost all electrotyping is therefore done by the plastic



McLaughlin Machinery

Electrotyping. 1. Preparing to press plastic sheet on to the metal original. 2. Stripping matrix from original. 3. Spraying plastic matrix with silver. 4. Peeling matrix from newly-formed electrotype

mould process, which is cheaper, quicker, and more accurate.

The matter to be reproduced is covered with a sheet of thermoplastic material such as vinylite and then placed in an electrically-heated hydraulic press which exerts a pressure of 250 tons. A small piece of copper gauze is at the same time embedded in the plastic. After approximately four minutes in the press at a tempera-

ture of 150° C., the plastic is peeled off and cleaned with detergent. The mould or matrix is treated with a sensitising solution so that silver will adhere to it, and is submitted to the silver-spray process. This is done in a covered booth, the spray gun being specially devised to eject two solutions from two separate nozzles at the same time—the silver nitrate solution and the reducing solution. As these sprays touch the p.v.c. sheet, a fine film of silver metal is deposited in so-called "monomolecular" thickness.

The coated p.v.c. is then removed to the electrolytic baths, where in one hour it receives its coating of copper. When the desired thickness (0.02 in.) is reached, the plastic sheet is peeled off from the newly formed metal sheet. The electrotype is hammered flat, and backed with a lead-base alloy, machined to thickness, and is ready for use as a printing block. The same process is used for producing blocks for colour printing, but nickel is first deposited on the silver film, to be followed by the copper deposition.

Electrum. Term applied at various times to different materials. In ancient days it was given to amber; in the Middle Ages to brass; more recently to an alloy of copper 8 parts, nickel 4, and zinc 3.5 (sometimes the nickel is 6 parts), a beautiful artificial silver with a bluish tint much used for the manufacture of drawing and other instruments; also to an alloy of copper, zinc, and tin, and to native minerals containing gold and silver, the latter 20–50 p.c. An alloy of gold and silver (15–35 p.c. silver) known by this term, of a pale yellow colour (hence the association of the material with amber), was much used by the early Greeks and Romans for ornaments and coins. The earliest coins known were made of it. Rods having 651 parts gold and 334 silver in 1,000 were used as money in Asia Minor.

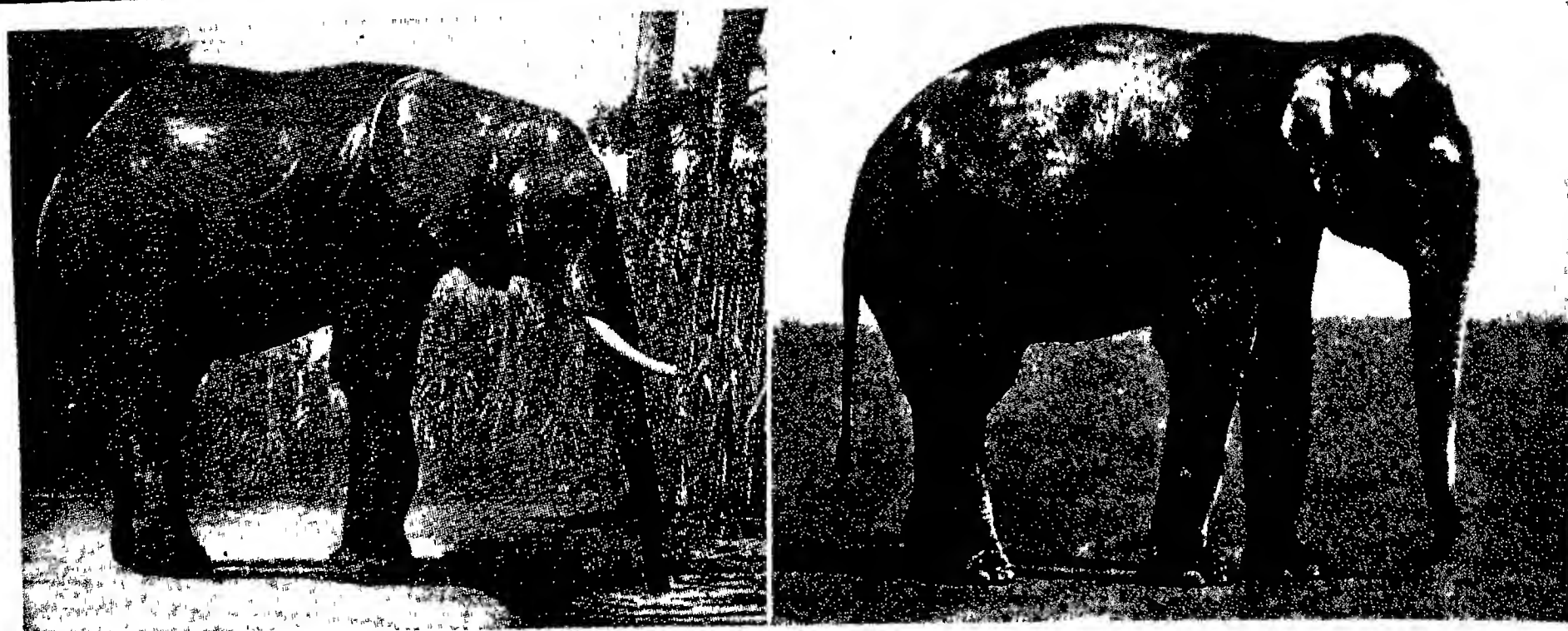
Elegy (Gr. *elegos*). Originally a threnody or lament written in elegiac metre, each couplet in which consisted of a hexameter and a pentameter. The theme of such songs varied, the term being used for the form rather than the spirit. In modern literature the elegy has been associated chiefly with the spirit rather than the form, and has come to be understood as a short mourning, or memorial song, usually a tribute to an individual, but sometimes of a

more generally mournful character, as is Gray's *Elegy Written in a Country Churchyard*, 1751.

Earlier poets used the term with wider significance, as when Donne described a series of his amatory poems as *Elegies* and labelled his memorial poems specifically *Funeral Elegies*. Although there were earlier memorial poems of distinction, such as the beautiful anonymous *The Pearl* (14th century) and Chaucer's *Book of the Duchess* (c. 1369), these can hardly be strictly described as elegies owing to their length and treatment. Some of the more notable elegies in English are Spenser's *Daphnida*, 1591 (on Lady Douglas), and *Astrophel*, 1595 (on Sir Philip Sidney); Milton's *Lycidas*, 1638 (on Edward King); Shelley's *Adonais*, 1821 (on John Keats); Tennyson's *Ode on the Death of the Duke of Wellington*, 1852 (his *In Memoriam* is rather a series of elegiac poems than an elegy); Matthew Arnold's *Thyrsis*, 1867 (on Arthur Hugh Clough); Swinburne's *Ave Atque Vale*, 1867 (on a false report of Baudelaire's death); and William Watson's *Lachrymae Musarum*, 1892 (on Tennyson).

Elektra. Opera in one act by Richard Strauss, with text by Hugo von Hofmannsthal, based on Sophocles's drama. In this work Strauss reached his climax as one of the most complex of composers (in his next work, *Der Rosenkavalier*, he returned to simpler forms). The musical characterisation in *Elektra* is masterly, and the opera is one of the most dramatic in the Strauss repertory. First performed at Dresden, Jan. 25, 1909, it was produced at Covent Garden under Beecham the following year.

Elektron Alloys. A group of light alloys with a magnesium base and varying amounts of aluminium, manganese, and zinc. Aluminium is added up to 10 p.c. to increase the strength; zinc up to 4 p.c. enhances this effect; $\frac{1}{2}$ to $2\frac{1}{2}$ p.c. manganese improves resistance to corrosion. Up to 1 p.c. cerium improves the mechanical properties at raised temperatures. Elektron alloys, being the lightest commercial alloys known, are used for aircraft engine parts, landing wheels, airscrews, etc., and for gear cases and parts of motor cars. They may be cast or wrought hot, but not cold. Some heat treatment and ageing are necessary to produce the optimum properties, but they are never quite so strong as best aluminium alloys. They are best joined by



Elephant. Left, African elephant, valuable by reason of its ivory tusks. Right, Asiatic elephant showing the whitish markings characteristic of this species

Photo of Asiatic elephant by Gambier Bolton, F.Z.S.

gas welding or the argon arc process. See Electric Welding.

Elemental Spirits OR ANGELS OF THE ELEMENTS. Spirits supposed to rule over the four elements of fire, water, air, and earth. The Jewish Kabbalists and the Gnostics of early Christian days largely developed this idea and introduced a host of minor angels or spirits who had charge of departments of the four great elements, such as wind, rain, etc. Hence arose an elaborate system of angelology not unlike demonology, but generally beneficial. In the Middle Ages, the spirits of fire were known as Salamanders; those of water as Nixies or Undines; those of air as Sylphs; those of earth as Gnomes. The name Salamander survives as that of a batrachian reptile supposed to be capable of living in fire.

Element. Term that has various meanings in science and technology. In chemistry, an element is one of the ninety-odd substances from which all solids, liquids, and gases are constructed. An element is defined as any substance which cannot be decomposed by chemical means into simpler substances. When two or more elements are present in a substance, the substance is called a compound. (See Chemical Elements; also table under Chemistry.) In electricity, an element is one of the electrodes of a primary or secondary cell. In astronomy, an element is one of the seven numerical quantities which specify completely the orbit of a planet, comet, or double star and enable its position to be calculated for any given time, past or future. Five of the elements define the size, shape, and orientation of the orbit; the other two suffice to locate the object in the orbit.

Elemi. Resinous exudation from a number of tropical plants.

especially *Canarium luzonicum*, a tree growing in Manila. The resin is of a pale yellow colour resembling stiff honey in consistency. It has an odour which reminds one of fennel. Elemi was formerly used in medicine as a stimulating application to wounds. The ointment contains about 20 p.c. elemi.

Elephant (Gr.-Lat. *elephas*). Family of hoofed mammals, surpassing in size all other existing land mammals. Two species survive, the African (with large ears and small eyes) and the Asiatic (with small ears and large eyes), though several others are known in the fossil state. The feature which distinguishes the elephant from all other mammals is the development of the nose into a long flexible trunk, used by the animal in conveying food to the mouth, and also for drawing up water which is afterwards squirted down the throat.

In dentition the elephant is unique. The incisors, which are found only in the upper jaw and are two in number, are developed in the male, sometimes in the female also, into a pair of long curved tusks. These tusks are quite different from those of the boar and other animals, which are simply large canine teeth. The elephant has no canines. Only two cheek teeth or molars, on each side of both jaws, are ever in use at any one time. These teeth are of great size, probably compound, and the surface consists of a large number of transverse ridges of enamel, parallel in the Indian and enclosing lozenge-shaped spaces in the African elephant. As these molars become worn out they are replaced by the reserve teeth, which grow through the gum.

The ponderous body of the elephant is encased in thick wrinkled

skin, covered sparsely with coarse hair in the young animal but almost bare in the adult. The legs are massive, and the knee joints are much lower down than in most hoofed animals. This causes the elephant, when lying down, to rest with the hind legs bent, while the fore legs are thrust out in front.

The head is enormous, and suggests the presence of a large brain. The brain is actually small for the size of the animal and is placed at the back of the head, the huge skull consisting of a mass of bone completely honeycombed by cells, an arrangement which provides for the attachment of the jaw and trunk muscles without making the skull so heavy as to be a burden.

Elephants are entirely vegetarian, feeding on leaves and twigs and on grass which they gather by the aid of their trunks. Trees are often uprooted by pressure with the head for the purpose of feeding on the branches. Where force is required, the elephant relies upon leverage with the tusks or pressure with the skull. The trunk is a delicate sense organ for smell and touch, and the animal is careful to keep it out of the way of rough usage. When an elephant holds a heavy weight it rests it on the tusks or holds it with the teeth, using the trunk only to steady it.

The Indian elephant is easily distinguished by its massive bulbous head, small ears, and the presence of four nails on the hind feet. It is dark grey, but occasionally more or less blotched with white. This elephant is rarely much more than 9 ft. high at the shoulder. It has a legendary reputation for longevity, but there is no well authenticated record of one reaching as great an age as 70.

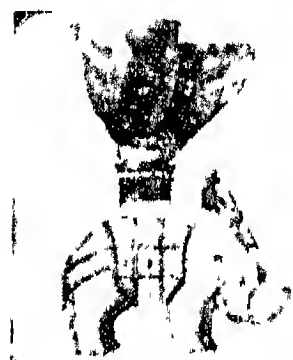
The African elephant has a smaller and narrower head, large

fanlike ears, and only three nails on the hind feet. Its trunk has two finger-like processes instead of one. It also attains a greater height, has longer legs, and a generally less heavy and clumsy appearance. Owing to continuous destruction for the sake of its tusks, the African elephant has been greatly reduced in numbers. This is of more savage disposition than the Indian species. Economically the African elephant is valued for its ivory, the Indian as a draught animal.

Elephant. Island of the South Shetlands, Antarctica. The most northerly of the group, it lies S.E. of Cape Horn and Drake Strait.

Elephant, ORDER OF THE. Danish order of knighthood refounded

in 1458 from an earlier institution, and remodelled in 1693. It is limited to 30 knights, exclusive of the sovereign and his sons, and is conferred only upon Protestants. The



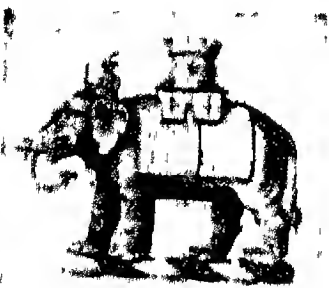
Order of the Elephant. Danish badge of knighthood

badge is a white elephant; the ribbon is of light blue watered silk.

Elephanta OR GHARAPURI. Island in Bombay Harbour, India. From 4 m. to 4½ m. in circumference, it consists of two long hills. It was so called by the Portuguese from a large stone elephant. The island is famous for its caves or rock temples, supposed to date from the 9th century. See Cave Temple illus.

Elephant and Castle. Design found in early MSS. and in medieval times. Elephants carrying armed men into battle were used in the East from immemorial days. They were first encountered by the Romans during the war with Pyrrhus in the 3rd cent. B.C. Polyænus records that an elephant carrying archers in a houdah led the advance when Julius Caesar forced the passage of the Thames near Chertsey in 54 B.C.

Caesar Frederick, a Venetian merchant of the 16th century, states that the king of Pegu had 4,000 war elephants with castles on their backs, and the Cutlers' Company, who had a large trade in ivory, adopted the animal so castled as their crest.



Elephant and Castle badge

Elephant and Castle. London tavern in the met. bor. of Southwark, 1¼ m. S. of Ludgate Hill.



Elephant Apple. Leaves, flower, and fruit, showing arrangement of seeds within the fruit

The tavern stands at a point from which six thoroughfares radiate: New Kent Road, Walworth Road, Newington Butts, St. George's Road, London Road, and Newington Causeway. It gives its name to a district (heavily damaged by German bombs in 1940) and to two rly. stations, one being a terminus of the Bakerloo tube rly.

Elephant Apple (*Feronia elephantum*). Large evergreen tree belonging to the family Rutaceae. A native of Coromandel, it has glossy leaflets and white flowers. The fruit is as large as an apple, with a hard, woody rind containing seeds embedded in pulpy flesh. The pulp is eatable and is made into a jelly; it is also useful in dysentery and diarrhoea. The wood is hard and heavy but not durable. The tree exudes from wounds a gum which forms a constituent of what is known as Indian gum-arabic.

Elephantiasis OR BARBADOES LEG. Disease characterised by chronic inflammation of the fibrous connective tissue, resulting eventually in excessive swelling of the leg, scrotum, arm, or breast, and less frequently other parts. The condition is due to obstruction of the lymph circulation by mechanical and inflammatory causes, the result of infection by a parasite worm, the filaria. The disease, which was recognized in ancient times, probably originated in



Elephant's-foot. Leaves and flowers of the S. African climber

Asia, and has spread thence to Africa, America, India, China, and Japan. Its distribution is influenced by that of mosquitoes, but the exact conditions governing its transmission have not yet been determined.

Elephantiasis frequently begins with high fever, pain in various parts of the body, and swelling of the extremities. The swelling may abate after the first attack, but in subsequent attacks the limb becomes more and more swollen until eventually it may attain an enormous size. Treatment is not very satisfactory. Castellani and Chalmers state that the best results are obtained by keeping the patient in bed and injecting fibrolysin daily for three to six months.

Elephantinē. Island in the Nile at Assuan, Upper Egypt. Marking the S. limit of ancient Nile navigation, it contained the Old Kingdom frontier station, Abu, or elephant town, an *entrepôt* of Sudanese trade. On the W. Nile bank opposite are rock-hewn tombs of Old and Middle Kingdom governors. Under Thothmes III, Rameses II, and other kings, its governor controlled the Assuan granite quarries. During the Persian supremacy there was a Jewish garrison, with a temple of Jehovah here. Aramaic papyri, recovered 1901 and 1906-08, elucidate 5th century life. An interesting object is the nilometer, recently renovated, which dates from the Ptolemaic period.

Elephant Seal (*Macrorhinus*). Large species of seal. It is called sea elephant because the nose is



Elephant Seal. A large marine animal found in the Indian and Southern oceans. It is also called the sea elephant

prolonged into a short proboscis in the adult male. Large specimens attain a length of 20 ft., and the girth is about equal to the length. These animals are found only in the Indian and Southern oceans.

Elephant's-foot, HOTTENTOT BREAD, OR TORTOISE PLANT (*Testudinaria elephantipes*). Perennial climbing herb of the family

Dioscoreaceae. It is a native of S. Africa. The huge rootstock (as much as 4 ft. across) is covered with a corky bark, ultimately cracked into angular protuberances. It contains a store of starch, eaten by the Bushmen. The slender stems climb to a height of 30-40 ft., and bear small heart-shaped leaves and sprays of tiny greenish-yellow flowers.

Elephant Shrew (*Macroscelides*, long-legged). Name sometimes given to the jumping shrew, owing to its long and trunk-like nose. They are small African insectivores and have the hind legs so long in proportion to the body that they look rather like miniature kangaroos. They are nocturnal in habit, feed mainly on insects, and proceed by a series of leaps.

Elephas Primigenius OR MAMMOTH. One of the extinct elephants, almost identical with modern elephants, but differing in greater development of curly tusks, and in the woolly hair. It was far more widely distributed than the modern elephant, remains being found in America, the bed of the North Sea, the Thames Valley, within the Arctic Circle, and in the frozen earth of N. Russia. See Mammoth.

Eleusine. Genus of grasses of the family Gramineae. Natives of warm regions, they are distinguished by the flower spikes being arranged finger-fashion at the top of the stem. As a genus they are of little importance, but *E. coracana* is grown in



Eleusine, showing the finger-like flowers

Japan and on the Coromandel coast, its large seeds being used as corn.

Eleusinian Mysteries. Festival of ancient Greece in honour of the nature goddess, Demeter, more especially that held at Eleusis (v.i.) in Attica in Sept. each year. Only those who were properly initiated were allowed to take part in the rites. The precise nature of the rites is not known, as they were never divulged in ancient times, though the festival continued till nearly A.D. 400. They were doubtless symbolical of the death of nature in autumn and its rebirth in spring.

Eleusis. Ancient city of Attica, on the coast 12 m. N.W. of Athens, chief seat of the worship of the goddess Demeter, in whose

honour the Eleusinian Mysteries were celebrated here each autumn without a break from archaic times until the destruction of the sanctuary by Alaric in A.D. 396. Participants made their way in procession from Athens along the Sacred Way, traces of which still exist. The Telesterion, or hall of mysteries, built by Pisistratus on the site of an earlier hall, was destroyed by the Persians in 480 B.C. and rebuilt on a larger scale later in the century with sides c. 165 ft. long and roof supported by 49 columns. Around the walls were seats for the initiates. The sacred enclosure was protected by two strong walls with monumental gateways; within, besides the Telesterion, were temples to Pluto, Demeter, Persephone, and Triptolemus, a sacred grotto, a sacred well, and a council hall. Eleusis was the birthplace of the poet Aeschylus. It was seized by the Thirty Tyrants for a short time in 403 B.C. The modern village of Levensina stands on the site of Eleusis.

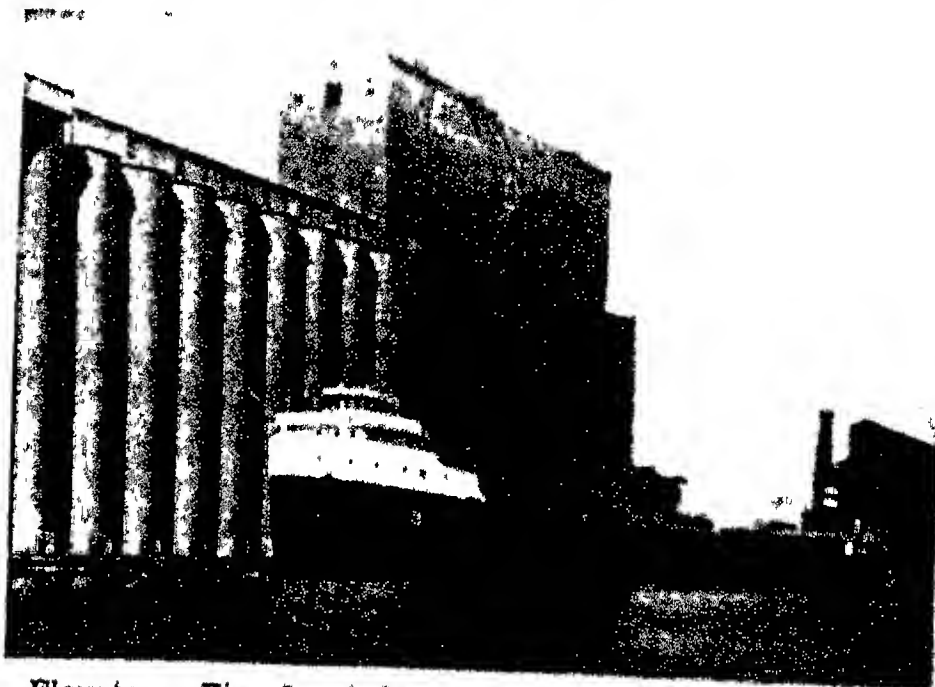
Eleuthera. Island of the Bahamas. It is 50 m. N.E. of New Providence, and is separated from Great Abaco by the Providence Channel. Long and very narrow, it is fertile and produces cascarilla, oranges, pineapples, onions, and tomatoes. The capital is Governor's Harbour, with a good, fortified harbour. Area, 235 sq. m. Pop. 6,430.

Elevation. In architecture and engineering, a side or end view of an object or representation on a perpendicular plane; also an end or side view of a building or machine drawn to scale without reference to perspective. In astronomy, the angular height above the horizon of a star or other celestial object. In gunnery, the amount of movement of the axis of a gun in a vertical plane, and also an angle formed between the axis of a rifle or gun and a horizontal plane.

Elevator (Lat. *elevare*, to lift up). In aeronautics, one of the horizontal tail control surfaces of an aircraft. When moved upwards, the elevators cause the machine to rotate about a lateral axis in such a way that the nose is tilted up-

wards, and the aircraft climbs. When the elevators are lowered there is an opposite effect.

Elevator. A grain silo or store equipped with elevating apparatus for taking in and discharging the contents. The name is given also to a lift for materials, goods, or passengers (*see* Lift). The grain elevator (Fig. 1) contains a number of deep vertical bins, circular, hexagonal, or square in plan, and constructed of steel plates or reinforced concrete; and is equipped with elevating, cleaning, distributing, and discharging apparatus. On arrival the grain is emptied by means of

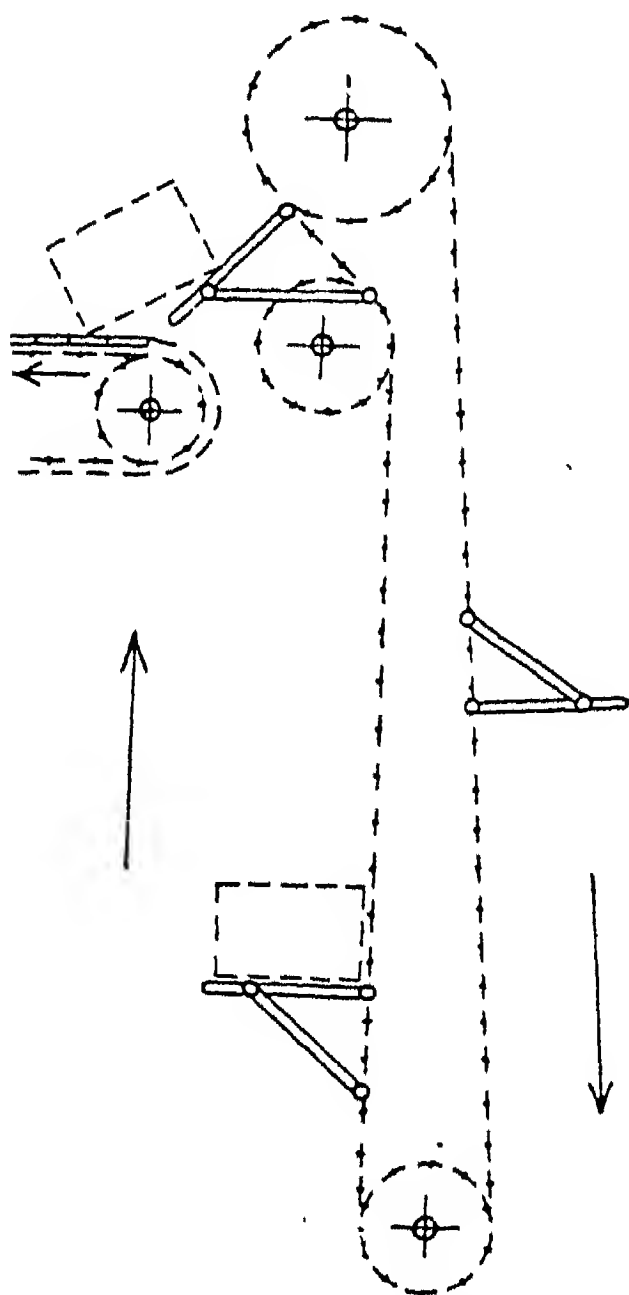


Elevator. Fig. 1. A lake freighter taking on a cargo from a grain elevator at Duluth, Minnesota, U.S.A.

a bucket or pneumatic elevator into a receiving chamber, whence it passes downwards, through an automatic weigher and a cleaning machine, to a bucket elevator, which carries it to the distributing floor at the top of the building. Here it is received on a system of belt conveyors and is rapidly delivered into one of the bins. These have conical bottoms and are self-emptying. Trucks are run under them and loaded directly, or the grain is transferred to ships by belt conveyors, or through spouts. The largest silos have a capacity of several millions of bushels; will take in 40,000-50,000 bushels an hour, and discharge 100,000 bushels and upwards in the same time.

The type for materials, etc. is in many respects like a conveyor (*q.v.*). Continuous chain and bucket elevators, either vertical or inclined, are used for handling coal in large boiler houses, delivering the coal into overhead storage bins, from which it flows through chutes to the boiler stokers. Fig. 2 indicates how a double-chain arm elevator can be used to raise bundles and deliver them automatically to a slat conveyor serving a store. A popular form

of machine for raising boxes in tall warehouses is the vertical swing-tray elevator, where the



Elevator. Fig. 2. Double-chain arm elevator used for raising bundles and delivering them to a slat conveyor serving a store

carriers are freely pivoted to two strands of Ewart chain. This type of package elevator is much used with gravity roller conveyors in warehouses and bottling stores.

Elf. Small being common to the folklore of most countries of northern Europe. Grimm says that an elf comes as much short of human size as a giant towers above it. The white elves are well formed and symmetrical, the black ugly and misshapen. The latter mostly work underground at their forges, and, like their white brethren on the earth's surface, take pleasure in teasing mankind. If left undisturbed they maintain peace with men and delight in doing them service; but if interfered with retaliate with mischief.

Elves were generally credited with wisdom and sometimes with divination. A common characteristic of the elf was his power of becoming invisible, frequently by means of a cloak or cap; thus, Siegfried in the Nibelungs' Song has an invisible cap which he obtains from Alberich, the elf-king. In most stories elves are peculiar to the earth and underground, and are scarcely distinguishable from the forge-working

dwarfs and gnomes of the mountains; while in others they are associated with light and flowers, and blend in the more general term of fays and fairies. There have been attempts to link the elf tradition with a primitive northern people of small stature.

Flint arrow-heads were called elf-arrows or elf-bolts from an idea that they were weapons of these little people. They are worn as amulets (ancient Etruria, Italy),

and reproduced for sale (Mecca). In Ireland water poured over them is given to cattle. Other things associated with them were elf-locks, hair matted together by them in mischief, or as they wore it; elf-child, a changeling; elf-knot, the hole in a piece of wood from which a knot has fallen, being the hole through which an elf can pass; night-elf, the nightmare; elf-light, will-o'-the-wisp; elf-lay, a fairy song. See Folklore.

ELGAR: GREAT BRITISH COMPOSER

Basil Maine, Author of *Life and Works of Elgar*

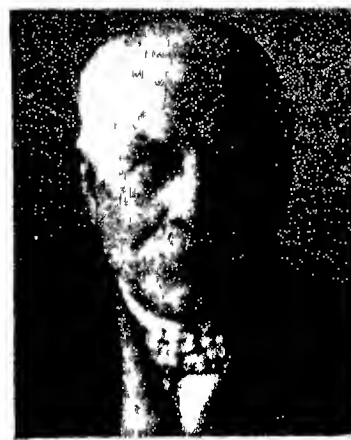
The life of the outstanding British composer of the early 20th century, who became also a notable figure in European music, told by his friend and biographer

Edward William Elgar was born at Broadheath, a village near Worcester, on June 2, 1857. His father, W. H. Elgar, was a native of Dover, who settled in Worcester in 1841 and established a music shop there; his mother was a native of the West Country, her maiden name being Anne Greening. As a boy, Elgar was surrounded by music and musical talk and activities. His father was organist of S. George's (Roman Catholic) church, Worcester, and as a violinist played in the orchestra at the Three Choirs' Festivals. Edward sometimes took duty for his father at the organ. He learnt to play the violin and the bassoon and was an active member of the Worcester glee club. For a time he worked in a solicitor's office, but all the time his mind was on music and every moment he could snatch was devoted to playing or to composition. Like his father, he was admitted to a place among the violins in the festival orchestra.

Bandmaster and Composer

At the age of 20, Elgar went to London to have violin lessons. He was appointed bandmaster at the Worcester county asylum and in this capacity gained knowledge of rudimentary orchestration. The year 1883 brought him before the public as a composer; an intermezzo which he had written was performed at an orchestral concert in Birmingham. During these impressionable years there came his way the music of Emanuel Bach, and of those almost forgotten composers, Schobert and Kozeluch; also examples of Tudor church music, the masses of Haydn

and Mozart, Meyerbeer, the operas of a travelling company's repertory, together with Shakespeare and Voltaire. These impressions were assimilated only to give the composer's individuality a keener edge; for, it can be confidently said, no composer's music is more immediately recognizable than Elgar's. Yet over half his life had passed before recognition came. Lack of encouragement made him diffident. He was approaching 40 before he became completely sure of himself. His marriage, in 1889,



Sir Edward Elgar, British composer

to Caroline Alice Roberts, was a factor in this gradual self-assurance. Until her death in 1920, his wife played the part of encouraging companion. Her influence can be judged from the fact that Elgar wrote no important work after her death.

The completion of the choral and orchestral work, *King Olaf* (1896), served to give Elgar confidence in his powers, but it was not until the orchestral work known as *Enigma Variations*, was produced in 1899 with Hans Richter as conductor, that the wider public acclaimed his genius. Assurance was made doubly sure by the production in 1900 of the great oratorio, *The Dream of Gerontius*. This was soon given in Germany, and the event was a landmark not only in Elgar's career but also in English music; Elgar had joined English music to the main European stream. After *Gerontius*, there followed the oratorios, *The Apostles* (1903) and *The Kingdom* (1906), the first symphony (1908), violin concerto (1910), second symphony (1911), and the sym-

phonic study, Falstaff (1913); and in each of these works, not to mention the introduction and allegro for strings and the cello concerto, Elgar establishes his claim to be ranked with the finest and most imaginative writers for orchestra.

When Elgar was at length accepted at his true worth (largely as a result of tributes from foreign musicians), honours came thick and fast. In 1904 an Elgar Festival was given at Covent Garden; the same year he was knighted; a year later Oxford made him an honorary doctor of music (he had already received an honorary degree from Cambridge), and he was appointed professor of music at Birmingham. During the war years beginning 1914, he, like other creative artists, was in a chastened mood. He turned to chamber music and also to work of a topical nature, such as Carillon, Polonia, and choral settings of verse by Laurence Binyon, called *The Spirit of England*. The 'cello concerto (1919) speaks of the sorrow which fills an artistic soul in time of war. In 1924 Elgar was appointed Master of the King's Musick.

Unfinished Symphony and Opera

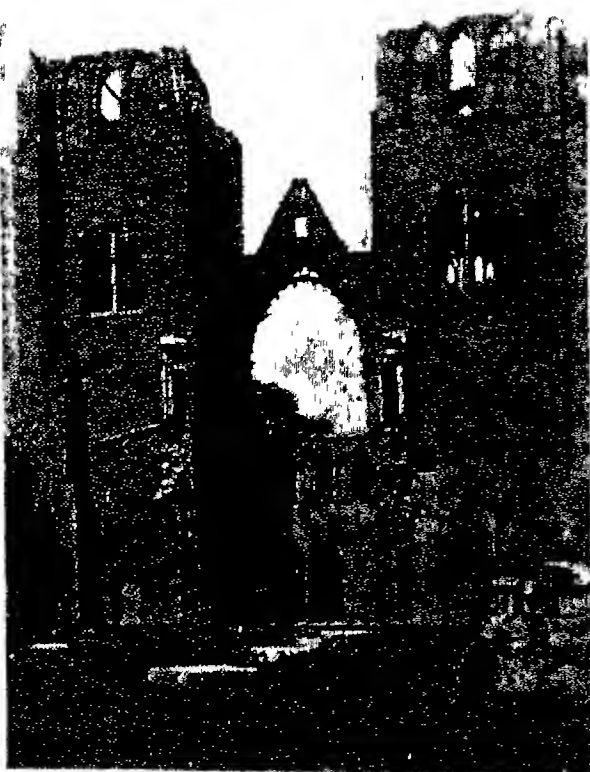
After 1920 Elgar wrote no major work, although his free orchestrations of a fantasia and fugue by Bach and an overture by Handel, and the nursery suite for orchestra give abundant evidence of the master hand. His 75th birthday was marked by a festival arranged by the B.B.C. It was then that the public heard that the B.B.C. had commissioned a third symphony from Elgar, but this work was interrupted by a painful illness, and on Feb. 23, 1934, he died, leaving unfinished not only his symphony, but also an opera to be called *The Spanish Lady*, based on Ben Jonson's play, *The Devil is an Ass*.

There is no insularity in Elgar's music. The liberal distribution of tastes and attractions during his youth was evidence of his mind's great range. Not that his music was unconditioned by national environment. In that respect he is in the company of Beethoven, Brahms, and Sibelius. But like these, he was nationalist by grace, not by adoption of folk-song. Melodies that once were folk-music but are no longer—these he eschewed; especially in compositions which were deliberately patriotic in motive. Instead Elgar wrote melodies of his own, one of which (*Land of Hope and Glory*)

became a "folk-song" in his own lifetime.

Elgar's was always a symphonic way of thinking. The spontaneity and nervous energy of his most characteristic music demand that the orchestra should have a free hand. In the oratorios and cantatas there are occasional passages where the purely musical part of Elgar's mind, with its continual aspiration towards the larger freedom of symphonic thought, appears to be fretting under the burden of the text. Among the finest symphonic composers of history, Elgar's name shines because of his peculiar genius for orchestral writing, which, incidentally, helped to raise the standard of orchestral playing in England. Elgar was loved by English orchestral players. The memory of early days when he was himself a bandsman filled him with a sympathetic appreciation of their work. He was one of them. Unsparingly he devoted himself to making his music understood by them. They have proved themselves worthy. English orchestras do indeed know their Elgar, the idiom of his phrase, the curve of his eloquence, the secret of bowing his ecstatic melody and of breathing his rich harmony. *Consult* Lives, B. Maine, 1933; P. M. Young, 1955; D. M. McVeagh, 1955; Letters, ed. P. M. Young, 1956.

Elgin. Royal burgh and co. town of Moray, Scotland, 80 m. N.W. of



Elgin, Scotland. The western towers of the ruined cathedral

Aberdeen; Lossiemouth, its port, is 5 m. to the N., with its own railway station. Elgin has ruins of a beautiful cathedral, founded in 1224, burnt down in 1270, rebuilt, and again destroyed by fire in 1390 by the Wolf of

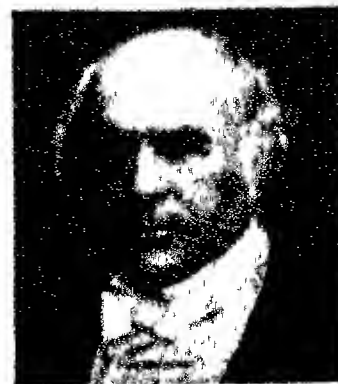
Badenoch. Restored to greater magnificence, it was wrecked by the fall of the central tower, 1711.

Remains exist of the bishop's palace, a royal castle, and monasteries of Blackfriars and Greyfriars; the Greyfriars chapel was restored by the third marquess of Bute. Woollen manufacture, iron-founding, and tanning are industries. (Sir) George Cooper presented a 40-acre park in 1903. Market day, Friday. Pop. (1951) 10,624.

Elgin. City of Illinois, U.S.A., in Kane co. On the Fox river, which supplies power for the industrial establishments, it is 36 m. W.N.W. of Chicago by rly. It has a reputation for watches and butter, though production of the latter has declined in favour of milk-processing. Manufactures include bottling equipment, ovens, thread. The academy of fine arts has a notable collection of American paintings. Settled in 1835, it was granted a city charter in 1854. Pop. (1950) 44,223.

Elgin, EARL OF. Scottish title held by the family of Bruce since 1633. Sir Edward Bruce, master of the rolls under James I, was made a baron in 1601, and his son Thomas was made earl of Elgin and later an English baron. The 2nd earl was made earl of Aylesbury in 1663. In 1746 the direct line failed, and there was a division of the titles, the earldom of Elgin passing to Charles Bruce, 9th earl of Kincardine, whose successors have borne the double title. Thomas Bruce, 7th earl of Elgin and 11th earl of Kincardine, a general in the army and ambassador at Brussels, Berlin, and Constantinople, is remembered as the collector of the *Elgin Marbles* (q.v.). The 10th earl (b. 1881) succeeded his father in 1917. The family seat is Broomhall, Fife, the earl's son is known as Lord Bruce, and the earl sits in the house of lords by virtue of a barony created in 1849. *Pron.* Elg-in.

Elgin, JAMES BRUCE, 8TH EARL OF (1811-63). British diplomatist. Born in London, July 20, 1811, son of the 7th earl, whom he succeeded in 1841, he was governor of Jamaica 1842-46, and governor-general of Canada 1846-54. He was raised to the British peerage in 1849. In 1857 he went as envoy



8th Earl of Elgin, British diplomatist

to China to demand reparation for the seizure of the British *lorcha Arrow*, and on the way out diverted his troops to assist Lord Canning in the Indian Mutiny. He negotiated the treaties of Tientsin and Yeddo in 1858, and in China again in 1860 secured the ratification of the treaty of Tientsin. In 1861 he was appointed viceroy of India, where he died, at Dharmasala, Nov. 20, 1863. *Consult* his Letters and Journals, 1872; Lives, J. G. Bourinot, 1905; G. M. Wrong, 1905; W. P. M. Kennedy, 1926; J. L. Morison, 1928.

Elgin, VICTOR ALEXANDER BRUCE, 9TH EARL OF (1849-1917). British statesman. Born at Montreal, May 16, 1849, when his father was governor-general of Canada, he was educated at Glenalmond, Eton, and Balliol College, Oxford. In 1863 he succeeded to his father's estates and titles, these including the earldom of Kincardine. With Gladstone he became a Home Ruler, and in the government of 1886 was treasurer of the household and first commissioner of works. During the years 1894-99 he was viceroy of India. In 1902 he was chairman of the royal commission appointed to inquire into the preparations for the South African War, and later of the one that reported on the ecclesiastical crisis in Scotland, caused by the judgement of the house of lords on the property of the Free Church. In 1905 Campbell-Bannerman made Elgin colonial secretary, but he did not retain this office when Asquith became premier in 1908, refusing then the marquessate offered him; his cautious policy and freedom from partisanship had not been altogether acceptable to his party. He died at Broomhall, Fife, Jan. 18, 1917.

Elgin Marbles. Collection of sculptures brought from Greece by the 7th earl of Elgin, while ambassador to the Porte. Keenly interested in the remains of ancient art in Athens and other Greek towns, he at first intended to have accurate drawings of them made, but seeing that they were fast going to ruin, he obtained the Porte's sanction to remove various relics. These consisted chiefly of sculp-

tures by Pheidias and other great artists from the Parthenon and the temple of Nikē Apteros (Wingless Victory) in Athens. Despite enormous difficulties, including the wreck of the ship conveying the precious cargo to England, the Elgin Marbles (as they were afterwards collectively called) were brought to London in 1806. Added to in later years up to 1812, they were finally acquired for the British nation in 1816 for £35,000, less than half of the sum (£74,000) Lord Elgin had paid to preserve them from total destruction, and are now in the galleries of the British Museum. Lord Elgin was accused by Byron and others of



Elgin Marbles. Two views of the north frieze of the Parthenon, now in the British Museum

vandalism, and even dishonesty, but the select committee of the house of commons appointed to investigate the whole subject exonerated him. During the Second Great War the marbles were stored in the disused Aldwych tube tunnel, London. *See* illus. p. 635.

Elgon. Extinct volcano, 14,140 ft. high. It stands on the frontiers of Uganda and Kenya Colony, 60 m. N.E. of the Victoria Nyanza. The rivers on the W. side drain into Lake Kioga, those on the E. into the Victoria Nyanza. The forest (about 50 sq. m.) on Mount Elgon is little known.

El Greco. Name by which the painter Domenico Theotocopuli (*q.v.*) is best known.

Eli. Judge and priest of Israel in the later period of the Judges. Through Samuel, who was in his service as a boy attendant, God indicated his anger at the misdeeds

of Eli's sons. When the news came that the Ark of the Covenant had been taken by the Philistines, and both his sons killed, Eli fell back and broke his neck.

Elia. Pen-name used by Charles Lamb. It was that of a clerk in the South Sea House, and was first assumed by Lamb when in 1820 he began to contribute essays to *The London Magazine*. *See* Essays of Elia; Lamb, Charles.

Elibank, VISCOUNT. Scottish title. A barony of the same name has been held since 1643 by the family of Murray. Patrick Murray, a person of importance in Selkirkshire, where Elibank is situated, and on the Scottish borders generally, was made a baronet in 1628, and a baron by Charles I in 1643. His title passed to his son Patrick in 1650, and then down a line of descendants, of whom George, the 6th baron, became an admiral. In 1871 Montolieu Fox Oliphant (1840-1927) became 10th baron, and in 1911 he was made a viscount of the U.K. His eldest son Alexander (1870-1920), made Baron Murray of Elibank in 1912 after serving as chief whip of the Liberal govt., died without an heir. Viscount Elibank's 3rd son, Charles Gideon (1877-1951) succeeded as 2nd viscount. He did distinguished service as administrator in New Guinea and South Africa, and published reminiscences, *A Man's Life*, 1933. His younger brother Arthur Cecil (b. 1879) succeeded as 3rd viscount.

Elie and Earlsferry. Burgh and seaside resort of Fife, Scotland. It is on the N. side of the Firth of Forth, 10 m. south of St. Andrews and 45 m. N.E. of Edinburgh by rly. It has fine golf links, a harbour and pier, and a coastguard station; there is a flashing light on Elieness. Pop. (1951) 1,190.

Elihu. The last of Job's comforters, as described in the Book of Job, chaps. 32-37. A young man, he reproved alike Job for being righteous in his own eyes, and the three older comforters for condemning Job without answering him. The burden of Elihu's speech is a justification of the ways of God. His words and character may have been added to the book by a later writer.

Elijah. Hebrew prophet. A native of Gilead (1 Kings 17), he lived in the days of Ahab. He appears to have led a kind of hermit life in the mountains, emerging only at intervals to denounce Ahab and attack the priests of Baal. On Mount Carmel he challenged

the priests of Baal to a test of the rival religions by calling down fire from heaven, after which he had to flee from the wrath of Queen Jezebel to Beersheba, where he seems to have wandered about the desert for six weeks.

When Ahaziah succeeded Ahab, Elijah warned him that he would die as a result of an accident that he had suffered. Towards the close of Jehosaphat's reign Elijah was still living, for he sent a letter to Jehoram, the king's son. When the end came, we are told that Elijah passed in a chariot of fire into the heavens. Jewish tradition long held that he would reappear before the coming of the Messiah, and the chair of Elijah is still set ready at the Passover meal.

Legend points out Elijah as the founder of the Carmelite Order, and in the Greek Church he is regarded as the patron saint of the mountains. He appears to have had some connexion with the mysterious religious communities known as the "Sons of the Prophets," of which there were a large number in Palestine in his period. In the N.T. he is referred to as Elias. His mantle and power fell to Elisha.

Elijah. Oratorio by Mendelssohn, set to texts from the O.T. First performed at Birmingham, Aug. 26, 1846, it was an immediate success and soon took its place after Handel's Messiah in popular favour in England. After revision it received its first German performance at Hamburg, Oct. 7, 1847. A stage version was given by the Moody-Manners Opera at Liverpool in 1912. An unusual feature is that the name part is for bass. Recitative, aria, duet, trio, quartet, and chorus are employed. The work is of great dramatic power, e.g. in the choral appeals to Baal, the declamation for soprano at the beginning of the second part; and such arias as Lord God of Abraham (bass) and O Rest in the Lord (alto) are often sung apart from the oratorio.

Elim Movement. A British evangelical sect which bears the title Elim Foursquare Gospel Alliance. It was founded in co. Monaghan, Ireland, by Pastor George Jeffreys, head of the organization until 1939. The name Elim is taken from the last verse of Exodus 15, where it is recorded that the Israelites encamped in the wilderness and refreshed themselves by the wells of water in the shade of a grove of palm trees.

Elim preaches the literal truth of the Scriptures, the efficacy of

divine healing through the laying-on of hands, and the imminence of Christ's second coming. It emphasises the close personal relationship between Christ and the sinner.

The Alliance is governed by a conference, which meets annually, consisting of representatives (ministers and laymen) from the churches. There are churches in London and the provinces, and the organization maintains home and overseas missions. Every Easter Monday it holds a festival in the Albert Hall, London, where new converts are baptized by total immersion. The headquarters are at 20, Clarence Avenue, Clapham Park, London, S.W.4.

Eliot, CHARLES WILLIAM (1834-1926). American educationist. Born at Boston, March 20, 1834, he was educated there and at Harvard. In 1854 he became a mathematical tutor at Harvard, and later assistant professor of mathematics and chemistry in the Lawrence scientific school. After studying in Europe he was appointed in 1865 professor of chemistry in the Massachusetts Institute of Technology. In 1869 he was chosen president of Harvard, being made president emeritus on his retirement in 1909.



Charles W. Eliot,
American
educationist

At Harvard Eliot did great work. He reconstructed the law and medical schools and introduced the elective system into the curriculum. The example of these achievements helped to raise the standard of academic education throughout the U.S.A. He was not only a great university administrator, but long exercised an unrivalled authority as an adviser on national questions. He twice declined the ambassadorship to Great Britain. His annual reports as president of Harvard were notable publications, and he also wrote *Educational Reform*, 1898; *Four American Leaders*, 1906; *The Road Towards Peace*, 1915. He died Aug. 23, 1926.

Eliot, GEORGE. Pen-name of Mary Ann, or Marian, Evans (1819-80); British novelist. She was



George Eliot,
British novelist

After F. D'Albert Durade

born at Arbury Farm, near Nuneaton, Nov. 22, 1819. The daughter of an estate agent, living for us in Adam Bede and in Caleb Garth (of Middlemarch), she early became wise in all that pertains to country life in Warwickshire, of which she has given us so intimate a picture. Her mother's death, and the marriage of her elder sister, Christiana (also drawn in Middlemarch), threw on her shoulders at 16 the responsibility of her father's household.

Here she was surrounded by the influences of evangelical revivalism, deeply confirmed by her aunt Elizabeth, the original of Dinah Morris (in Adam Bede).

A move to Coventry in 1841 brought her into a more literary atmosphere. A student of German and Italian, Latin and Greek, and music, she now mingled with those for whom books were their most treasured companions and philosophy the chief staple of daily talk. Though too sensible and affectionate to risk permanently estranging her father by any formal and visible break with the religious observances of her childhood, she turned her mind to such tasks as a translation of Strauss's *Life of Jesus*, and in her heart gave up orthodox faith for ever.

Entry into Journalism

When in 1849 the old man died, it was natural that she should seek further freedom of intellect in London among the men and women then chiefly inspired by the materialistic agnosticism of Herbert Spencer. She was soon assistant-editor of the *Westminster Review*, where she published weighty articles on ethics, through which she met George Henry Lewes. The union between them, life-long though not tied by legal marriage, was not lightly entered upon. George Eliot's preoccupation with the problems of married life, her continual insistence upon the binding nature of promises between husband and wife, are pathetic testimony to her uneasiness in a position that could so easily be criticised from her own standard of duty. But as she had entered into it with deliberation, she never admitted disloyalty to her own conscience; and from a literary point of view, the consequences were an unmixed gain.

It was Lewes who first discovered her genius for fiction,

Instantly recognizing a new force in literature, he encouraged her diffident aspirations, and himself carried out all the negotiations with editors and publishers, which resulted in the anonymous appearance of three stories in Blackwood's Magazine, published in 1858 as the well-known *Scenes of Clerical Life*. Immediately popular, they were followed by *Adam Bede*, 1859; *The Mill on the Floss*, 1860; and *Silas Marner*, 1861. Henceforth she lived happily and strenuously among the thinkers of the day, a professional woman of letters, whose work enjoyed much critical appreciation, popularity, and influence among thoughtful

lesser degree her later novels, reveal the dangers of undigested analysis in imaginative writing; she was weighted with anxiety about the soul of mankind. But because she was before all things a great artist and a warm-hearted and sympathetic woman, she was able to create an immortal gallery of human beings, whose joys and sorrows can never lose their hold on the affections. Her excellent professional training secured fine fruit for her varied powers of ordered memory, acute observation, and dramatic instinct. The earlier novels reach right into the heart of things because they are built on the most intimate experiences

of youth, with spontaneous humour and deep emotion. If the style, the plot, and the psychology of what followed yield somewhat to affected pedantry, we have, at least in *Middlemarch*, many a revelation in emotional problems.

Like her great feminine predecessors she was realistic and paro-

chial; but what Charlotte Brontë first bitterly proclaimed on a few passionate topics became with George Eliot a definite philosophy universally applied. She insisted that women should dare to think for themselves, establish their own moral standards, follow their own conscience, and even demand man's acquiescence. No writer of fiction has illustrated with greater power the ultimate ethical truths of life, the tragic pathos of continual backsliding, and the eternal significance of the choice between good and evil. Her passionate faith, indeed, called for more than reason could give to doubt. Her message was not final. But she left an unrivalled revelation of much that our forefathers were feeling, thinking, and striving for: a living picture of Victorian domesticity, the farmer, the tradesman, and their womenfolk.

R. Brimley Johnson

Bibliography. Life, as related in *Letters and Journals*, ed. J. W. Cross, 3 vols., 1885; *Lives*, O. Browning, 1890; L. Stephen, 1902; J. L. May, 1930; J. Bennett, 1948; L. and E. Henson, 1952; *Selected Letters*, ed. R. B. Johnson, 1926; *Letters*, ed. G. S. Haight, 7 vols., 1954-56.

Eliot, Sir John (1592-1632). English politician. Born at Port Eliot, Cornwall, and educated at Exeter College, Oxford, he was knighted in 1618, and in 1619 was appointed vice-admiral of Devon as a supporter of the duke of Buckingham. First elected M.P. in 1614, he made an attack on Buckingham in 1626 and was sent to the Tower. On release he was a principal promoter of the Petition of Right, 1628. On March 2, 1629, Eliot drafted and Holles read a protest against unauthorised taxation, whilst the Speaker was forcibly held down in his chair. Two days later Eliot was sent to the Tower. He remained there until his death, Nov. 27, 1632. He is regarded as a martyr for parliamentary freedom. *Consult* Lives, J. Forster, 1864; Harold Hulme, 1957.



Sir John Eliot,
English politician
From a painting in the
possession of the Earl
of St. Germans

Eliot, John (1604-90). English missionary to American Indians. He was born at Widford, Herts, and educated at Jesus College, Cambridge. In 1631 he went to America and in 1646 became a Protestant missionary to the Indians in Massachusetts. His headquarters were at Natick; and he died at Roxbury, May 21, 1690. Eliot translated the Bible into the native dialects, in addition to preparing a grammar and catechism. He assisted in the preparation of the famous Bay Psalm Book (q.v.).

Eliot, Thomas Stearns (b. 1888). An American-born British poet. He was born Sept. 26, 1888, at St. Louis, Mo., and educated at Harvard, the Sorbonne, and Merton College, Oxford, a cosmopolitan training which is reflected in his poetry. After 1913 he lived mainly in London where, after a short time as a bank clerk, he taught and lectured. His first volume of poems, *Prufrock and Other Observations*, was published in 1917, and contained work dating from 1909. It reflected mainly the New England period of his life and included four acid comments on Boston society written in 1915; the earliest poem he



John Eliot,
English missionary



George Eliot. Arbury Farm, Nuneaton, where George Eliot (Mary Ann Evans) was born, Nov. 22, 1819

middle-class readers. Her later output embraced *Romola*, 1863, a painstaking reconstruction of the past; *Felix Holt, the Radical*, 1866, a political treatise; *Middlemarch*, 1871-72, a problem novel with three loosely-knit plots; *Daniel Deronda*, 1876, a study of an alien race; besides *The Spanish Gypsy* and *The Legend of Jubal* in verse, and the somewhat ponderous collection of short essays entitled *Impressions of Theophrastus Such*. After Lewes's death in 1878, she married in 1880 John W. Cross, afterwards her biographer, but died Dec. 22 that year.

George Eliot's Sense of Duty

It was the grafting of a somewhat arid philosophy upon the Calvinism of early years that gave distinction and popularity to George Eliot's work. Always profoundly religious, and mastered at all times by an uncomfortably strict sense of duty, she met the questionings of the mid-Victorians with a rare and illuminating sincerity, and awoke echoes in many a young, ardent spirit newly alive to the serious mysteries of life.

She was, in fact, more receptive than original or independent; her poems, and *Theophrastus*, and in

allowed to be printed, *Conversation Galante*, written at 19; and three of his most characteristic poems, *Portrait of a Lady*, *The Love Song of J. Alfred Prufrock*, and *La Figlia che Piange*, written—in that order—between 21 and 23.

Eliot's friendship with Ezra Pound profoundly influenced his technique. Together the two poets read and studied the same sources, interchanged ideas, and made similar experiments in versification; and his next volume, *Poems*, 1920 showed a complete contrast with his earlier work. It contained a series of biting satires, of which *The Hippopotamus* (1917) was the first, and four poems in French. In the same year he published his first volume of criticism, *The Sacred Wood*. In one of the essays, *Tradition and the Individual Talent* (1917), he explained his theory of poetry; and in others, notably those on the Elizabethans, gave clues to the influences at work on his own writing.

The Waste Land

The publication of *The Waste Land* in 1922 marked Eliot's emergence as a major poet. This poem of 433 lines, with its fifty annotated references and other literary and historical allusions, its quotations in five different languages (including Sanskrit), its variety of rhythm, and its elliptical phrasing is a comment on modern civilization. Its apparent obscurity and unquestionable difficulty ensured that its original impact was on a small literary circle; but it gradually won acceptance and exercised a decisive influence on younger poets for twenty years. In 1922 also Eliot founded and edited *The Criterion*, a literary review, which until its cessation in 1939 maintained an unquestioned supremacy among critical magazines. The new venture was published by the firm of Faber, of which Eliot became a director.

In 1925 he published his first volume of collected poems; in 1927 he became a naturalised British subject and about this period joined the Church of England. In the preface to his second volume of essays, *For Lancelot Andrewes* (1928), he described his general point of view as "classicist in literature, royalist in politics, and Anglo-Catholic in religion." His next volume, *Ash Wednesday* (1930), a sequence of religious poems, announced what was thereafter to be the main preoccupation of his thought and work—a mysticism which found its culmination in *Four Quartets* (1944) comprising

Burnt Norton, *East Coker*, *The Dry Salvages*, and *Little Gidding*, which had been separately issued between 1936 and 1942.

Throughout the 1930s the religious issue dominated Eliot's work, whether in a topical pamphlet like *Thoughts after Lambeth* (1931); in a pageant play, *The Rock*, written for performance at Sadler's Wells Theatre in 1934 on behalf of the Forty-Five Churches Fund of the Diocese of London; in a play on Becket, *Murder in the*



T. S. Eliot, British poet

Cathedral, which was performed in Canterbury Cathedral in 1935 and subsequently had an outstanding success in London; or in a series of lectures, *The Idea of a Christian Society*, delivered in 1939 at the invitation of the master and fellows of Corpus Christi College, Cambridge. Eliot's dramatic work was heralded by the publication in 1932 of *Sweeney Agonistes*, described as "fragments of an Aristophanic melodrama." Later plays were *The Family Reunion*, 1939; *The Cocktail Party*, 1949; *The Confidential Clerk*, 1953.

During the 1930s academic recognition came to him. In 1932 he returned to the U.S.A. as Charles Eliot Norton professor of poetry for 1932-33 in his old university of Harvard, delivering the lectures which were subsequently published as *The Use of Poetry and the Use of Criticism*. Awarded hon. Litt.D. by several universities, including Oxford and Cambridge, he received in 1948 the O.M. and the Nobel prize for literature.

Eliot remains a unique phenomenon in English letters, with imitators rather than successors. It is difficult to analyse the nature of the poetry which, a quarter of a century after the publication of

The Waste Land, many readers still find obscure; but it may be epitomised by saying that, in endeavouring to communicate his vision to his readers, he relies not on a subjective expression of his own emotions but on finding an objective standard of reference—which he calls "the objective correlative"—which will evoke the same response from both writer and readers. This objective correlative may be an historical incident, a person, a phrase from another writer, a classical allusion, a reference to an anthropological treatise, the chorus of a popular song, a piece of popular devotion. Many of his poems have thus a superficial appearance of plagiarism or parody; and nearly all contain recondite literary allusions which present problems to those less erudite than himself.

Hugh Ross Williamson

Elis. Country on the W. coast of Peloponnesus, Greece. Its chief city was Elis, on the Peneus, while another city, Pylos, was the seat of the kingdom of the Homeric hero Nestor. In Elis was the district of Pisa, where the great Olympic games were held every four years. It forms the modern nome of Ilia; the capital is Pyrgos. Area 1,150 sq. m. Pop. (1951) 188,274.

Elisabeth. Mother of John the Baptist, whom she bore in old age (Luke 1). She was the wife of Zacharias, a priest in the Temple, and cousin of the Virgin Mary.

Elisabethville. Town in the extreme S. of the Belgian Congo and headquarters of the prov. of Katanga. It is 2,305 m. N.N.E. of Cape Town and 292 m. S.E. of Bukama, on the Luabala portion of the Congo river. The Étoile du Congo mine is 8 m. distant, and there are other rich copper deposits in the neighbourhood. Pop (est.) 133,000 (white 11,000).

Elisha. Son of Shaphat, and companion of the prophet Elijah, whose successor he became (2 Kings 2). At the translation of Elijah he received his mantle as a sign of office. He flourished in the reigns of Jehoram, Jehu, Jehoahaz and Joash, and had considerable influence in public affairs.

Elixir (Arab. *el iksir*, the philosopher's stone). In pharmacy, a preparation containing alcohol, flavouring agents, sometimes active ingredients like senna. It is a tincture of various substances held together by alcohol. In alchemy, the elixir of life (*elixir vitae*) was believed to be a substance which would prolong indefinitely the life of anyone who consumed it.

Elizabeth. City of New Jersey, U.S.A., the co. seat of Union co. It is near the mouth of Elizabeth river on Staten Island Sound and Newark Bay, 14 m. S.W. of New York. It makes rly. equipment, sewing machines, motor cars, hardware, and tools, and has oil refineries, chemical works, and shipyards. In 1664 colonists from Long Island made it the first English settlement in New Jersey. In 1747 the College of New Jersey (forerunner of Princeton) was opened. Elizabeth became a borough in 1740, a town in 1796, and a city in 1885. In three air crashes in 1952, 118 persons were killed in Elizabeth, after which the nearby airport of Newark was closed. Pop. (1950) 112,817.

Elizabeth. Feminine given name. It originated in a Hebrew word, Elisheba, meaning God hath

sworn, and became very popular throughout the Christian world. It has various forms, one of which is Isabella, and is common in eastern Europe as well as in the west. Eliza, Elsie, and in Scotland Elspeth are among its abbreviations.

Elizabeth (1207–31). Hungarian princess and saint. Daughter of Andrew II of Hungary, she was born at Pressburg (Bratislava) and gave herself to the ascetic life. Married in 1221 to Louis IV of Thuringia, she was driven from the court on his death in 1227. Renouncing the world, she lived at Marburg, subjecting herself to the severest penances and self-denial. She died there on Nov. 19, 1231, and was canonised in 1235, after many miracles reported from her tomb. Nov. 19 is her festival. (*Consult Lives*, W. Canton, 1922; F. J. von Weinrich, 1933.

ELIZABETH I: LAST OF THE TUDORS

J. Hurstfield, Reader in Modern History, University College, London

This biography is one of the most important of the series on the sovereigns of England and Scotland. Further information is under England: History; Mary, Queen of Scots; Armada. See also biographies of Burghley; Drake; Leicester; Philip II, etc.

Few Englishwomen, and no English queen, can have spent their childhood and adolescence, as did Elizabeth Tudor, in such personal and political insecurity. Born on Sept. 7, 1533, to Henry VIII and his second wife Anne Boleyn, she became, before she was three years old, both illegitimate and motherless as the result of the nullification of her parents' marriage and the execution of Anne. But the "Lady Elizabeth" continued to occupy a position of honour in the royal household, and the act of 1544, establishing the succession, placed her third in line after her half-brother Edward and her half-sister Mary. Another 14 years would see Elizabeth on the throne of England but before then, during the preceding reign of Mary I, she would live in the direst peril.

Child of the "Protestant" marriage which had snapped the link between England and Rome, reared in a Protestant environment and taught by Protestant tutors, Elizabeth was the focus of all the political and religious discontents against Catholic Mary. During Wyatt's rebellion of 1554, Elizabeth was said to be implicated; but in her first exercise in statecraft this young woman of 21 proved fully equal to men more than twice her age. Nothing could be proved. She was imprisoned in the Tower of London:

only her cool handling of a desperate situation—or her innocence—saved her from taking the last steps from the Tower to the block. Four years later, on Nov. 17, 1558, she became queen.

She was now 25 years old: young enough to be flexible, old enough to have acquired the political skills which her unique



Elizabeth

From an engraving by W. Rogers in the collection of H.M. the Queen

experiences could teach her. Flexibility joined with the patient and realistic pursuit of the national interest were, indeed, the qualities most needed at this crucial stage in English history. For her throne and her state were threatened by a rival claimant in Mary, Queen of Scots, backed by France; and if the French hold on Scotland should ever tighten, then the English nation might be reduced to a satellite of a Valois empire. Alternatively, a Roman Catholic alliance between France and Spain, if that should ever come about, might extinguish for all time the English Protestant bastion against the counter-Reformation. These dangers never materialised, partly because the intense rivalry between France and Spain made it unlikely that Philip II would join in any project to make England safe for a French protégée, partly because Mary's own country, Scotland, soon broke out into open rebellion against her. But these factors alone might not have saved England had not Elizabeth displayed to the highest degree a brilliant Renaissance diplomacy involving neither open war, nor too flagrant an assertion of her Protestantism, nor a dogmatic affirmation of principles. Instead, with subtlety and finesse, and with a limitation of her objectives, she intervened just sufficiently in Scotland to remove the French and at the same time avoided an open breach with the great powers in Europe. That policy she pursued, though with increasing difficulty, for nearly 30 years.

Religious Policy at Home

Elizabeth I tried to follow the same policy at home, in the matter of religion. Unlike her sister, she had nothing of the zealot in her and judged that by now England needed a stable, moderate, religious policy, Protestant enough to draw in many of her subjects yet sufficiently Catholic in doctrine and ceremonial to buy time from her Roman Catholic subjects as well as from Philip II and the pope. Time indeed proved that Elizabeth was right; but for most of her reign there were vigorous minorities hostile to the middle path who had to be resisted. From 1570, when the pope issued his bull of excommunication and deposition, a determined Catholic minority, including some of the ablest and most idealistic of people, sought to keep alive the old religion in spite of the increasingly heavy penalties inflicted



Queen Elizabeth I

By an unknown artist (National Portrait Gallery)

upon recusancy; while the punishment of a traitor was accorded to the priest-missionaries coming in from the Continent, and to those who harboured them.

Plots against the life of the queen there were: for example, the rising of the Northern Earls of 1569, the Ridolfi plot of 1571, and the Babington plot of 1586, in which Mary, Queen of Scots, was implicated, and for which she paid with her life in 1587. But the majority of Roman Catholics held aloof and, a year later, in the hour of crisis when England faced the Armada, no "fifth column" struck at the nation from the rear. With the execution of Mary, and the disappearance of the last serious Roman Catholic claimant to the throne, those who stood for the old religion showed themselves no less patriotic than those who adopted the new.

Rise of the Puritans

But amongst the adherents of the new religion were men, far more extreme than the Roman Catholics, who set out to purify the Church—hence their name, Puritans—and who in the process would have brought revolution in both church and state, as they did in Scotland. To them Elizabeth offered a stubborn resistance, believing as she did that an excess

of zeal, coming from any quarter, would split the country, open the door to a bloody struggle at home and intervention from abroad, and end the English monarchy as she understood it. The struggle between the queen and the Puritans—who found support in the highest quarters in the realm—went on throughout most of her reign. Towards its close, the movement appeared to weaken considerably, only to break out with renewed vigour early in the reign of James I.

The Puritans had drawn a good deal of their strength from their allies in the house of commons. Here too they were in a minority, determined, well-organized, and influential—and a thorn in the flesh of the queen. The death of Elizabeth without an heir would, they believed, put the whole Protestant settlement in jeopardy: and they pressed her to marry without delay. Robert Dudley, earl of Leicester, she loved and, at the beginning of her reign, she might have married him. But the mysterious circumstances in which Amy Robsart, his wife, died in 1560, and his own unpopularity ruled out marriage. After that, the various other marriage projects which she entertained were

part of her complicated diplomacy, and no more, with the possible exception of the suit of the duke of Anjou whom she seriously considered marrying when she was 48 and he 26; but that too came to nothing. As she grew past childbearing the debate shifted from marriage to the nomination of her successor; but that she refused to do, believing that it must lead to divided allegiance, even in her own lifetime. Only on her deathbed, it is thought, did she give her approval to the succession of her second cousin, James VI of Scotland.

"Gloriana"

From parliament also, in the latter part of her reign, during the exhaustive and expensive years of war, there came opposition to her use of monopolies and to other aspects of her economic policy; but on the whole she was secure in the esteem of the overwhelming majority of her subjects. After her death her reputation grew, making as it did a contrasting splendour with the bluster and blunders of the Stuarts who succeeded her; but even in her own day the cult of Gloriana left its mark not only on the politics but on the poetry, drama, and maritime expansion of her age. When she died on March 24, 1603, a little short of her seventieth birthday, Hawkins's brilliant escapades against the Spaniards, Drake's circumnavigation of the world, 1577-80, and the heroic sacrifice of Grenville of the *Revenge*, 1591, were already part of the emergent dream of Empire. At the same time, in literature, the names of Spenser, Sidney, Bacon, and Shakespeare, among a host of others, showed that the creative genius of Elizabethan Englishmen was not restricted to any one field. The last of her line, Elizabeth I was a woman of considerable culture, wit, political acumen, courage, and patience. Associated with her for the whole of her reign until his death in 1598 was her great minister, William Cecil, Lord Burghley; they presided over a realm which achieved a happy combination of stability with expansion.

Bibliography. Lives, M. Creighton, 1899; J. E. Neale, 1952; The Reign of Elizabeth, J. B. Black, 1936; The England of Elizabeth, 1950, and the Expansion of the Elizabethan Age, 1955, A. L. Rowse; Elizabeth I and her Parliaments, J. E. Neale, 2 vols., 1953, 1957; Mr. Secretary Cecil and Queen Elizabeth, C. Read, 1955.



Death mask of Elizabeth I

H.M. QUEEN ELIZABETH II

The life of a princess who, though at her birth she seemed unlikely to become queen regnant of the United Kingdom of Great Britain and Northern Ireland, was destined to accede to that office

Elizabeth the Second, by the Grace of God of the United Kingdom of Great Britain and Northern Ireland, and of her other Realms and Territories Queen, Head of the Commonwealth, Defender of the Faith, was born at 12, Bruton Street, London, W.1 (London home of her maternal grandparents), on April 21, 1926, the elder daughter of the duke and duchess of York, later King George VI and Queen Elizabeth. She was baptized Elizabeth Alexandra Mary. At the time of her birth there was no particular likelihood that she would succeed to the throne, for her uncle the prince of Wales (afterwards Edward VIII and later duke of Windsor) was not yet 32; and she might well have had a brother.

Her upbringing was simple; her studies included, in addition to the usual subjects, economic and constitutional history, and the trend of political developments. She acquired a real feeling for history and a marked sense of the richness of the tradition into which she had been born. She became a good horsewoman and a fine swimmer. An excellent pianist, she counted the drama as her other favourite among the arts.

The death of her grandfather George V and the abdication of her uncle in 1936 made her heiress presumptive, and thereafter her training was adjusted to fit her for her now probable duties as queen regnant. On her 16th birthday her father made her honorary colonel of the Grenadier Guards; and in Nov., 1944, she launched H.M.S. Vanguard. She was gazetted to a commission in the A.T.S. on March 5, 1945.

On her 21st birthday, while on a tour of S. Africa with her parents, Elizabeth broadcast to the British Commonwealth a moving dedication of her life to its service; it included the memorable sentence, "I declare before you all that my whole life, whether it be long or short, shall be devoted to your service and the service of our great imperial family to which we belong."

Elizabeth's betrothal to her third cousin, Philip Mountbatten (see Philip, Duke of Edinburgh, Prince) was announced on July 9, 1947, soon after her return from South Africa, and they were married at Westminster Abbey

on Nov. 20. A son, Charles Philip Arthur George, was born on Nov. 14, 1948; a daughter, Anne Elizabeth Alice Louise, on Aug. 15, 1950.

In May, 1948, Princess Elizabeth and the duke of Edinburgh paid a short state visit to Paris, where they received a great welcome from president and people. During 1949 the duke resumed his naval duties, and for a time the princess went to Malta to be near him. Then she and her husband toured Canada in 1951, and had just left for a prolonged tour of Ceylon, Australia, and New Zealand when King George VI's death, on Feb. 6, 1952, recalled them to London. The queen, publicly proclaimed as Elizabeth II on Feb. 8, was crowned in Westminster Abbey on June 2, 1953 (see illus. in p. 2382). In the following Nov. the queen and the duke carried out an extensive tour of the Commonwealth. In 1955 they spent three weeks in Nigeria; and they

paid state visits to Norway, 1955; Sweden, 1956; Portugal, France, and Denmark, 1957.

The queen's style as adopted in 1953 in the U.K. and all other territories for whose foreign relations the U.K. govt. is responsible is given at the beginning of this article. Owing to 20th-century constitutional developments it varies in different parts of the Commonwealth. In Canada, Australia, and New Zealand it follows that of the U.K., except for the omission of the words "of Great Britain and Northern Ireland" and the specific mention of Canada,



Elizabeth II. A portrait taken soon after her accession. Her tiara was first worn by Queen Victoria. Above, the queen in her first year

Australia, or New Zealand before "her other Realms and Territories." In South Africa and Ceylon the style is simply "Queen of South Africa" (or Ceylon) "and of her other Realms and Territories, Head of the Commonwealth." Pakistan accepted the style "Elizabeth the Second, Queen of the United Kingdom and of her other Realms and Territories, Head of the Commonwealth," until it became a republic, when, like the Republic of India, it acknowledged the queen as "Head of the Commonwealth."

Elizabeth (c. 1437-92). Queen consort of Edward IV of England. She was the daughter of Sir Richard Woodville, afterwards Earl Rivers, and was married first to Sir John Grey, who died in 1461. The young king met the handsome widow while hunting, and married her secretly in 1464, and in 1465 she was acknowledged queen and crowned. Of her children by the king her elder son became king as Edward V, and her eldest daughter, Elizabeth, became the queen of Henry VII. She refounded Queens' College, Cambridge, originally founded by Margaret of Anjou. She was buried at Windsor.

Elizabeth (1465-1503). Queen consort of Henry VII. The daughter of Edward IV and Elizabeth Woodville, she was born at Westminster, Feb. 11, 1465. She was unmarried when Edward died in 1483, and after the murder of her two young brothers in the Tower, she was his heiress. She was then in the power of Richard III, who contemplated marrying her. Elizabeth was probably in the plot that culminated in the battle of Bosworth. She and Henry were married, after parliament had approved of the match, Jan. 18, 1486, the rival houses of York and Lancaster being thus united. She was crowned queen Nov. 25, 1487. Elizabeth had seven children: Arthur; Henry, afterwards Henry VIII; Margaret, who became the wife of James IV of Scotland; and Mary, afterwards the wife of Louis XII of France; and three who died in infancy. She died Feb. 11, 1503.

Elizabeth (b. 1900). Queen consort of George VI of the United Kingdom of Great Britain and Ireland, and of the British Dominions. She was born Aug. 4, 1900, at St. Paul's Walden Bury, Herts, third daughter of the 14th earl of Strathmore and Kinghorne. On her mother's side

she was descended from Elizabeth, consort of Henry VII, on her father's from Sir John Lyon of Forteviot, who in 1372 married the daughter of Robert II of Scotland. Lady Elizabeth Angela Marguerite Bowes-Lyon spent most of her childhood either at St. Paul's Walden Bury or at Glamis Castle, Angus, Scotland.

On Feb. 12, 1923, her engagement to the duke of York was announced, and the marriage was celebrated at Westminster Abbey on April 26. The duke and duchess took up residence for a time at White Lodge, Richmond



Elizabeth, Queen Consort of George VI. Her Majesty at the state opening of the Union parliament, Cape Town, in Feb., 1947

Park. Their elder daughter (later Queen Elizabeth II) was born, April 21, 1926, while they were residing at 12, Bruton Street, London, W.1, London home of the duchess's parents, and shortly before they went to Australia to open the new parliament house at Canberra. In 1927 they went to live at 145, Piccadilly, London, where they remained ten years. On Aug. 21, 1930, Princess Margaret was born at Glamis Castle, the first member of the British royal family to be born in Scotland since a younger brother of Charles I.

On Dec. 11, 1936, the duke of York succeeded his brother, Edward VIII, as king, and on May 12, 1937, Queen Elizabeth was crowned with him in Westminster Abbey. She launched the liner that bears her name on Sept. 27, 1938. Long before the outbreak of the Second Great War she was actively en-

gaged in furthering the cause of Great Britain, and the support of the North American continent owed much to the visit paid by the royal couple to Canada, Newfoundland, and the U.S.A. in May-June, 1939. There, as during their state visit to Paris in 1938, the queen's charm of manner, ready sympathy, simplicity, and true understanding endeared her to men and women in every walk of life. These qualities were in still greater evidence during the war. In Sept., 1940, bombs fell on four occasions on Buckingham Palace, and with King George she replied to a cabinet message: "Like so many other people we have now had a personal experience of German barbarity which only strengthens the resolution of us all to fight through to final victory." She broadcast several messages full of appreciative sympathy to the women of the Empire, France, and the U.S.A.; and as commandant-in-chief of the Women's Navy, Army, and Air Force services she often inspected units belonging to these services.

In Feb.-April, 1947, the royal couple paid a state visit to S. Africa, where the queen's qualities evoked the same friendly response as they had received in N. America eight years earlier. In the last years of George VI's life, she was called on to support him through severe illness. After his death and her daughter's accession, Feb. 6, 1952, she assumed the style and title of H.M. Queen Elizabeth the Queen Mother.

Elizabeth (1837-98). Empress of Austria. Born Dec. 24, 1837, the daughter of Maximilian I, king of Bavaria, she married Francis Joseph of Austria, April 24, 1854. Her attempts to modify the strict etiquette of the imperial court aroused opposition amongst the nobility, but she soon gained the love of the people and retained it to the last. In 1867 she was crowned queen of Hungary. In 1889 her only son, Rudolph, died in very tragic circumstances; her cousin, Leopold of Bavaria, committed suicide, and her sister, Sophie, duchess of Alençon, was killed in a fire at a Paris charity bazaar, 1897. The empress herself was mortally stabbed by an Italian anarchist at Geneva, Sept. 10, 1898. There are *Lives* by K. Tschuppik, Eng. trans. E. Sutton, 1930; and Count Corti, Eng. trans. C. A. Philips, 1936.

Elizabeth (b. 1876). Queen of the Belgians. She was born July 25, 1876, at Posenhofen, into a

younger branch of the Bavarian royal family. On Oct. 2, 1900, she was married at Munich to Albert (1875-1934, *q.v.*), who in 1909 became king of the Belgians. During the First Great War she worked constantly for the good of her people, often visiting the front line



Elizabeth, Queen of the Belgians

with her husband. After his death in a mountaineering accident she withdrew from public life, and was at Laeken during the German occupation of 1940-44. Leopold III was her son, as was Prince Charles, who acted as regent for his brother 1944-50.

Elizabeth (1596-1662). Queen of Bohemia. The eldest daughter of James I of England, she was born at Falkland, Fife, Aug. 19, 1596. In 1612 she was betrothed to the elector palatine Frederick V, whom she married early in 1613, beginning wedded life at Heidelberg. In 1618 Frederick was chosen king of Bohemia, and the Thirty Years' War began. He and his wife were crowned at Prague in 1619 and lived there for a time, but soon were fugitives, the queen ultimately reaching Holland, where Maurice of Orange befriended her. By this time Frederick had lost the palatinate as well as Bohemia, and the exiled pair remained in Holland, where in 1632 the elector died.

Elizabeth strove to obtain the lost palatinate for her eldest surviving son, Charles Louis, and in 1648 had the satisfaction of seeing him settled at Heidelberg. He did nothing, however, to relieve the poverty to which she was reduced by her husband's misfortunes and the loss of her own annuity as an English princess after the Civil War broke out. She remained in Holland, befriended by the earl of Craven, to whom report, probably incorrectly, said she was married. In 1661 she crossed over to England and was given a pension by Charles II. She was living in Leicester Square, London, when she died, Feb. 13, 1662. Elizabeth had thirteen children; two, Rupert and Maurice, fought in the Civil War for their uncle, Charles I, and the twelfth was Sophia, the mother of George I. She was beloved by the English, and Henry Wotton addressed a famous poem to her. *Consult* Life, C. Oman, 1938; Letters, ed. L. M. Baker, 1953.

Elizabeth (1843-1916). Queen of Rumania. Born at Neuwied, Dec. 29, 1843, she was the daughter



Elizabeth

of Prince Hermann of Wied. In 1869 she married Prince (later king) Carol of Rumania. She endeared herself to her adopted country by ministrations to the wounded in the war with Turkey (1877-78), and founded the order of Elizabeth to reward distinguished Red Cross work. She became a widow Oct. 10, 1914, and died March 2, 1916.

A fine musician, and no mean painter, the queen wrote under the pen-name of Carmen Sylva and published poems and stories in Rumanian, German, French, and English. Her chief works are *Stürme*, 1881; *Leidens Erden-gang*, 1882 (Eng. trans. by M. A. Nash as *Suffering's Journey on the Earth*, 1905); *Les Pensées d'une Reine*, 1882; *Pelesch Märchen*, 1883, a book steeped in Rumanian folk-lore. *Consult* Carmen Sylva, Queen and Woman, E. Burgoyne, 1941.

Elizabeth (1709-62). Empress of Russia. Daughter of Peter the Great, and therefore called Elizabeth Petrovna, she was born near Moscow, Dec. 18, 1709. She is said to have married a common soldier when quite young. During her cousin Anne's reign, 1730-40, she took no part in court affairs, but gave



Elizabeth, Queen of Frederick, Elector Palatine, King of Bohemia. Hampton Court Palace

rein to her somewhat abandoned tastes. On Dec. 6, 1741, aided by her intimates and partisans, she dethroned the child emperor, Ivan VI, by a *coup d'état* at the Winter Palace, and mounted his throne. Throughout the Seven Years' War she worked steadfastly for Russian interests, implacable in her opposition to Frederick II of Prussia. Joining with France and Austria against Prussia in 1757, she was a tower of strength in the combination that brought Prussia almost to destruction by the end of 1761, her army having entered Berlin in 1760. To Frederick's great relief, Elizabeth died Jan. 5, 1762, whereupon the alliance against him collapsed. Before her accession an indolent woman, as empress she ruled with unselfish energy, strengthening Russian prestige all over Europe, and carried out various internal reforms. She founded the university of Moscow, 1755, and the academy of arts at St. Petersburg (Leningrad).

Elizabeth (1635-50). English princess. The second daughter of Charles I, she was born Dec. 28,



Elizabeth, English princess From an old print

1635. She was placed in the charge of parliament, and appealed in a touching letter to the house of lords for permission to retain her attendants. In 1648 she helped her brother James, duke of York, to escape. She said goodbye to her father the day before his execution, and, after a visit to Penshurst, was sent to Carisbrooke Castle, where she died, Sept. 8, 1650, from fever. She was buried in S. Thomas's church, Newport, where is a monument to her by Baron Carlo Marochetti erected by Queen Victoria in 1856.

Elizabeth PHILIPPINE MARIE HÉLÈNE (1764-94). French princess, usually known as Madame Elizabeth. Born at Versailles, May 3, 1764, she was a granddaughter of Louis XV. Devoted to her brother Louis XVI, she accompanied him on his flight to Varennes, and shared his captivity in the Temple. Accused of aiding Louis in 1792, she was guillotined, May 10, 1794.

Elizabeth. Pen-name of a British novelist whose life and work are described under the heading Russell, Mary Annette, Countess.

Elk (*Alces machlis*; Gr. *alkē*, Lat. *alcēs*). Largest member of the deer family, known in America as the moose. The European elk is found in Scandinavia, Finland, Poland, and parts of Russia; after greatly diminishing in numbers it began to increase in mid-19th century. The adult is about 7 ft. high at the withers, and may weigh over 1,000 lb. It is very long



Elk. Specimen of the common elk, or moose, *Alces machlis*

in the leg, of heavy build, short in the neck, with long ears, and has a long head with overhanging muzzle. The antlers of the male are broad and palmated. It inhabits dense forests, where it feeds mainly on the leaves and young branches of the willow and birch as well as on lichens and moss. The flesh is apt to be coarse, and has a musky flavour.

Elk. Group of mountains of Colorado, U.S.A. A section of the Rockies near Aspen, in Castle Peak, they rise to 14,259 ft.

El-Kab. Site of the ancient city Nekheb, near the right Nile bank, 44 m. above Luxor, Upper Egypt. The predynastic capital of the S., it was sacred to the vulture-goddess Nekhbet, identified by the Greeks with Eileithya, goddess of childbirth—hence the city's later name Eileithyaspolis. Within the girdle-wall, 37 ft. thick and enclosing 75 acres, Quibell conducted excavations in 1897. In the vicinity are many rock-cut tombs. The royal residence lay across the stream at Nekhen (Hieraconpolis).

Elkan, BENNO (b. 1877). German sculptor. Born at Dortmund, Dec. 2, 1877, he was educated in Switzerland and studied in Paris and Rome. He was represented in international exhibitions in Germany, France, Italy, and England, where he worked from 1933. His works included tombs, busts, medals, and monuments; his war memorials in Germany were removed by the Nazis. In England he achieved fame by a statue of Raleigh and bronze candelabra with biblical figures for King's

Chapel, Cambridge. Other works include The Four Cardinal Virtues, at Buckfast Abbey, and a plaque at the Rudyard Kipling memorial building, Windsor.

Elkesaites OR ELOHASAITES. Heretical 3rd century sect which followed alleged revelations contained in the Book of Elchasai. This taught that the Son of God had been manifested in the persons of many good men, and that Christ was merely one manifestation.

Elkhart. City of Indiana, U.S.A., lying 100 m. E. of Chicago, in Elkhart co., at the junction of the Elkhart and St. Joseph rivers. It makes 60 p.c. of all band and orchestral instruments played in the world. Other products are motor and aircraft, railway and steamship equipment, pumps, presses, and tools. There are several rlys. and an airport. Settled about 1833, Elkhart received its city charter in 1875. Pop. (1950) 35,646.

Elkhound. Sporting dog, very hardy, with compact body, pointed ears, and broad skull, originating



Elkhound. Breed of sporting dog

in Scandinavia and used to hunt the elk. The coat is thick, coarse, and weather-resisting, the long outer coat grey tipped with black. The undercoat is soft and woolly. The tail, covered with thick hair, is tightly curled over the back. Height $18\frac{1}{2}$ to $20\frac{1}{2}$ ins. at the shoulder, weight 43 to 50 lb. The elkhound is bold, friendly, intelligent, and independent, with excellent power of scent.

Elkington, GEORGE RICHARDS (1801–65). British manufacturer. Born Oct. 17, 1801, at Birmingham, the son of a spectacle-maker, he became partner and afterwards sole proprietor of his uncle's silver-plating business in that city. By energy and experiment he made electro-plating a commercial proposition, and superseded the old-fashioned method of plating by soldering thin sheets of silver upon copper. He died Sept. 22, 1865.

Elk's-horn Fern (*Platynerium*). A small genus of epiphytal ferns native to Australia, Malaya, Africa. The barren lower fronds are thick

and undivided, and spread close to the tree-trunk on which they grow. The much longer fertile fronds present the appearance of a stag's antlers.

Ell (Lat. *ulna*, Ger. *ellenbogen*, Eng. elbow). Medieval European measure of length. It varies from the English ell, probably borrowed from France, which equals 45 ins., to the Scottish of 37 ins. and the Flemish of 27 ins.

Ellagic Acid or BEZOARDIC ACID ($C_{14}H_6O_8$). Constituent of the animal concretions which are met with in Oriental countries under the name of bezoars. It can also be made artificially by treating gallic acid in acetic acid solution with potassium persulphate and sulphuric acid. The name is Fr. *galle* (gall) reversed, with suffix *ic*.

Elland. Town and urban district of the West Riding of Yorkshire, England. It stands on the Calder, 3 m. S.E. of Halifax, and makes woollen and worsted goods, and rayon, and has cotton mills, iron foundries, and fireclay works. The 12th-century parish church of S. Mary has some 15th-century glass. Until 1950 Elland gave its name to a parl. div. Pop. (1951) 19,275.

Ellenborough, EDWARD LAW, BARON (1750–1818). British lawyer. Born at Great Salkeld, Cumberland, Nov. 16, 1750, he was educated at Charterhouse and Peterhouse, Cambridge. He was called to the bar in 1780 and eight years later was leading counsel for Warren Hastings (q.v.). In 1802 he was appointed lord chief justice and created a peer. He was the only chief justice to accept a seat in the cabinet. He resigned office in Nov., 1818, and died Dec. 13.

Ellenborough, EDWARD LAW, EARL OF (1790–1871). British administrator. Born Sept. 8, 1790, the eldest son of Baron Ellenborough he was educated at Eton and S. John's College, Cambridge, and in 1813 entered parliament. Made lord privy seal in 1828, he became president of the board of control, and in 1841 governor-general of India. He crushed the Afghans, annexed Sind in 1842 and subdued Gwalior, 1844. Made an earl on his recall, he was first lord of the Admiralty in 1846, and



1st Earl of Ellenborough. British administrator

president of the board of control in 1858. He died Dec. 22, 1871.

Ellen's Isle or EILEAN MOLACH. Islet in Loch Katrine, Perthshire, Scotland. It is the scene of Scott's *Lady of the Lake*.

Ellerman Lines. British steamship company. An offshoot of the Bibby Line, founded in 1840, it was purchased in 1870 by F. Leyland and Co., and flourished as the Leyland line until 1902, when it was sold, the Atlantic service being acquired by the International Mercantile Marine, a U.S. combine, and the Mediterranean services by Sir J. R. Ellerman (1862-1933).

Ellerman Lines Ltd. controls the City, Ellerman, Hall, Bucknall, Papayanni, Westcott, and Laurance lines. The City and Hall lines run passenger and cargo vessels from Liverpool and Glasgow to India and Africa; the Ellerman and Bucknall lines operate services to Africa, Australia, New Zealand, India, and the Persian Gulf, the Far East, and New York; the Westcott and Laurance lines serve the Mediterranean, Black Sea, and the Danube ports from London; while the Ellerman and Papayanni lines have similar services from Liverpool. The Ellerman lines lost 60 vessels during the Second Great War. The headquarters of the combination are 104-107, Leadenhall St., London, E.C.3.

Elles, Sir Hugh Jamieson (1880-1945). A British soldier. Born April 27, 1880, in India, he went to Clifton and the R.M.A. He was gazetted to the R.E. in 1899 and served in the South African War. He passed the Staff College course, 1913-14. Crossing with the B.E.F., he served in France throughout the First Great War. He was promoted temporary major-general commanding the Tank Corps in 1918, and was created K.C.M.G. in 1919. Elles was director of military training at the War Office, 1930-33, and master general of ordnance, 1934-38; colonel commandant of the Royal Tank Regiment from 1934, and of the R.E. from 1935. Promoted general in 1938, he retired the same year and was regional commissioner for S.W. England in 1939-40. He died July 11, 1945.

Ellesmere. Urban dist. and market town of Shropshire, England. It is 11 m. S.W. of Whitchurch on the rly. and on the mere and canal of the same name. No traces remain of its castle, whose site is now occupied by a bowling green. S. Mary's church



Ellen's Isle, in Loch Katrine, immortalised in Scott's poem, *The Lady of the Lake*

is a fine Gothic structure. Agriculture is the main industry. There is excellent fishing in the district. Market day, Tues. Pop. (1951) 2,159.

Ellesmere. An island in the district of Keewatin, N.W. Territories, Canada. It is the largest of the most N. group of Eastern Arctic Islands, and is separated from Greenland by Smith Sound and Kennedy and Robeson Channels. The N. portion is known as Grant Land, and the country to the S.E. as Grinnell Land from its discovery in the second Grinnell expedition, 1854. The interior W. was explored by Greely and Lockwood (1882-83). The E. coast is steep and rocky, and part of the interior is covered by an extensive ice-cap, but on the W. coast are low rolling areas which supply vegetation for roaming herds of caribou and musk-ox. The highest named peak in Grinnell Land is Mt. Arthur (5,000 ft.) but there are higher ranges beyond. In Lady Franklin Bay, Grant Land, Tertiary coal has been found, the most northerly deposit of fossil fuel known.

Ellesmere, Earl of. British title borne since 1846 by the family of Egerton. Frances Leveson-Gower, a younger son of the 1st duke of Sutherland, assumed the name of Egerton in 1833, when he inherited the estates of the Egertons, dukes of Bridgewater. He was a politician with remarkably enlightened views, and won some distinction as a writer and a patron of the arts. He was created Earl of Ellesmere in 1846, and died Feb. 18, 1857. The 5th earl was born in 1915 and succeeded his father in 1944. He has property at Newmarket and at St. Boswells, Roxburghshire. An eldest son is called Viscount Brackley.

Ellesmere Port. Borough of Cheshire, England. It is 7 m. N. of Chester, on the Mersey, and the first port of call on the Manchester ship canal. One of the largest oil ports in the U.K., it has iron, paper

and dye-works, flour mills, and, at Stanlow, a large oil refinery. Pop. (1951) 32,653.

Ellice Islands. Group of coral islands in the Pacific Ocean. Called the Lagoon islands, they lie N. of Fiji, between lat. 5° 30' and 11° 20' S. and long. 176° and 179° 50' E. The chief industries are connected with phosphates and copra. Formally annexed by

Great Britain in 1915 as the Gilbert and Ellice Islands Colony, they are under the jurisdiction of the high commissioner for the W. Pacific. Area 10 sq. m. Pop. 4,400.

Never attacked by the Japanese, they formed an advanced Allied base during the winter of 1942-43.

Ellichpur. Town of India, in the state of Bombay. It is 100 m. W. of Nagpur, and was once an important city and a military cantonment; but its prosperity has declined. By local tradition it is supposed to date from the 11th century; it is known to have been prominent in the 13th century, and then passed under Mahomedan rulers. Besides an old palace, the town contains early remains, including a burial shrine associated with a mythical hero, Shah Abdur-Rahman. Cotton is the chief industry. Pop. 21,200.

Ellington, Edward Kennedy (b. 1899). American negro musician. "Duke" Ellington was born at Washington, April 29, 1899, and first conducted his own band in New York in 1926. Next year, conducting as Duke Ellington at the Cotton Club in Harlem, he achieved an enormous reputation for "hot jazz" and soon took his band throughout the U.S.A. and in 1933 on a European tour. A master of orchestral colour, jazz rhythms, and effective dissonance, he composed songs like *Mood Indigo* and *Solitude* which remained long in the dance music repertory.

Ellington, Sir Edward Leonard (b. 1877). British air force officer. He was born on Dec. 30, 1877, educated at Clifton and the R.M.A., and commissioned in the Royal Artillery in 1897. He transferred to the R.F.C. 1913, and served in France during the



Sir Edw. Ellington, British air force officer

First Great War. Director general of supply and research at the Air ministry, 1919, he was created a K.C.B. the following year. In 1923 he was A.O.C., R.A.F., in India; in 1929 A.O.C.-in-C., Air Defence of Great Britain. Ellington was appointed chief of the air staff in 1933, and was inspector-general of the R.A.F. 1937-40. He was promoted marshal of the R.A.F. in 1937.

Elliot, JANE OR JEAN (1727-1805). Scottish song writer. The daughter of Sir Gilbert Elliot, 2nd bart., of Minto, she is famous as the author of *The Flowers of the Forest*, which Sir Walter Scott included in his *Minstrelsy of the Scottish Border*, 1802. She died in Edinburgh, March 29, 1805.

Elliot, JOHN (d. 1808). British sailor. Son of Sir Gilbert Elliot, a Scottish judge, he entered the navy and in 1758 served under Hawke and Anson. He distinguished himself in 1760 off the coast of Ireland in the capture of three French vessels. After serving in the Mediterranean and at Plymouth he commanded the *Trident* to America. In 1779 he sailed under Rodney to the relief of Gibraltar, distinguished himself at St. Vincent, and fought under Kempenfelt. During 1786-89 he was commander-in-chief at Newfoundland, and was promoted admiral, 1795, when he retired. He died Sept. 20, 1808.

Elliot, WALTER ELLIOT (b.1888). British politician. Born Sept. 19, 1888, he was educated at Glasgow academy and university and became a doctor, serving as such in the First Great War. He entered parliament in 1918 as Unionist member for Lanark. From 1924 until



Walter Elliot,
British politician

defeated by 88 votes in 1945 he represented the Kelvingrove division of Glasgow. He sat for the Scottish universities 1946-50, and in 1950 was returned again for Kelvingrove. He was minister of Agriculture, 1932-36, secretary for Scotland, 1936-38, minister of Health, 1938-40, and director of public relations at the War office, 1941-42. P.C. 1932, F.R.S. 1935, he was made C.H. 1952. He was Lord High Commissioner to the Church of Scotland general assembly 1956 and 1957.

Elliot, CHARLOTTE (1799-1871). English hymn-writer. She was born at Clapham, March 18, 1789,

and after an uneventful life, passed for the most part as an invalid, she died at Brighton, Sept. 22, 1871. Her hymns, amounting to about 150, placed her among the foremost British women hymn-writers. Many became popular, notably "Just as I am, without one plea."

Elliott, EBENEZER (1781-1849). British poet, known as the Corn Law Rhymer. Born at Masbor-



Ebenezer Elliott,
British poet
From a contemporary sketch

ough, Yorks. March 17, 1781, he was engaged, like his father, in the iron trade. He attributed his father's ruin and his own early losses to the bread tax, and in his *Corn Law Rhymes* (1831) he depicted in vigorous language and with intense feeling the sufferings of the poor under the Corn Laws. His hymn beginning "When wilt Thou save the People?" is still sung. He died at Great Houghton, Dec. 1, 1849.

Elliott, GRACE DALRYMPLE (c. 1758-1823). Reputed mistress of George IV. She was a daughter of Hew Dalrym-



Grace Dalrymple
Elliott,
British adventuress
After Cosway

ple, an Edinburgh lawyer, was educated in France, in 1771 married John Elliott, and was divorced in 1774. About 1782 she gave birth to a daughter, of whom the prince of Wales acknowledged himself the father. She subsequently settled in France, and died near Sèvres, May 16, 1823. Her account of her life during the French Revolution was published in 1859.

Elliott, MAXINE (1873-1940). American actress. Born at Rockland, Maine, Feb. 5, 1873, she began acting in The Middleman, with E.S. Willard (New York, Nov. 10, 1890), and was soon taking leading parts, including that of Mrs. Allenby in *A Woman of No Importance*. Her

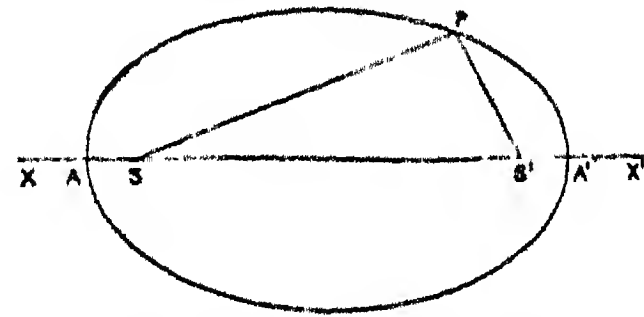


Maxine Elliott,
American actress
L. Caswall Smith

Shakespearian renderings were greatly praised. Her first appearance in London was as Silvia in *The Two Gentlemen of Verona*, Daly's, July 2, 1895; thenceforward she acted in England frequently, a notable success being *Zuleika* in *Joseph and His Brethren* (His Majesty's, 1913). She died March 6, 1940. Her sister, Gertrude (1874-1950), also an actress, married Sir Johnston Forbes-Robertson (q.v.).

Elliott, WALLACE HAROLD. British clergyman. Educated at Coll- yer's School; Brasenose College, Oxford; and Ripon Clergy Col- lege, he was curate of Guisborough, 1907-09; vicar of Holy Trinity, Folkestone, 1918-29; canon and precentor of St. Paul's Cathedral, 1929-30; vicar of St. Michael's, Chester Square, 1930-34; pre- centor, 1941, sub-dean, 1945-48, of H.M. Chapels Royal; vicar of St. Mary's, Warwick, 1948-49. hon. canon of Coventry Cathedral, 1948-49; became chaplain of the order of St. John of Jerusalem, 1944. He was a notable radio preacher in the 1930s. Published works include *Undiscovered Ends* (autobiography); *The Christian in His Blindness*.

Ellipse (Gr. *elleipsis*). A curve such that the sum of the distances of any point on it, from two fixed



Ellipse. SS' , foci on the axis XX' . AA' principal diameter. P is any point on the ellipse, and has the property that $SP + S'P$ is constant

points within it, is constant. When the fixed points coincide the curve becomes a circle. See *Conic Sections*.

Ellipsis. Figure of speech, whereby part of a sentence, strictly necessary for complete fullness of expression, but which can easily be supplied from the grammatical connexion, is omitted. It is often deliberately employed in writing, in order to lay stress upon what is more important and essential, unessentials being omitted.

Ellipsoid. Solid of which all sections are either ellipses or circles. See *Geometry*.

Ellis, HENRY HAVELOCK (1859-1939). British author and psychologist. Born at Croydon, Feb. 2, 1859, he studied medicine at St. Thomas's Hospital, London, but before qualifying went to Australia, where he spent 1875-79 as a

teacher. Returning to England, he qualified, but after two years in medical practice he gave himself



Havelock Ellis,
British author and
psychologist

almost exclusively to literary and scientific work. From 1889 to 1914 he edited the *Contemporary Science Series*. A student of the pathological and psychological aspects of sex,

in 1897 he published the first volume of studies in the *Psychology of Sex*, the seventh and final volume appearing in 1928. Although this was written as a strictly scientific treatise and made no effort to popularise the subject, the first volume gave rise to an outburst of scandalised vituperation and a prosecution followed, with the consequence that later volumes were published in the U.S.A. He died July 8, 1939.

Ellis's psychological work was based upon biological study rather than experimental work; therefore his position has been obscured by the greater popularity enjoyed by Freudian psychology. His writings are distinguished by a deep sympathy and understanding combined with what was when he began to write a new and scientific approach to old problems. In addition to *Studies in the Psychology of Sex*, Ellis wrote on general literary and psychological subjects, e.g. *The New Spirit*, 1890; *The Criminal*, 1890; *Affirmations*, 1897; *The Nineteenth Century*, 1900; *The World of Dreams*, 1911; *The Philosophy of Conflict*, 1919; *Little Essays of Love and Virtue*, 1922; *The Dance of Life*, 1923; *Sonnets from the Spanish*, 1925; *My Confessional*, 1934. His autobiography, *My Life*, appeared posthumously in 1940.

Ellis, MARY (b. 1899). American actress and singer. Born in New York, June 15, 1899, she became an art student and subsequently studied singing, making her first appearance on the London stage in 1930 in *Knave and Quean*. The following year she played in O'Neill's *Strange Interlude*. Other successes include *Music in the Air*, 1933; and she was associated with Ivor Novello in his productions, *Glamorous Night*, 1935; *The Dancing Years*, 1939; *Arc de Triomphe*, 1943, and *The Gay Pavilion*, 1945. She also made films in Hollywood.

Ellis, ROBINSON (1834–1913). British classical scholar. He was born at Barming, Kent, Sept. 5, 1834, and educated at Rugby and Balliol College, Oxford, where his career was most distinguished. In 1883 he became reader in Latin at the university, and in 1893 professor of Latin. He is chiefly known for his work on Catullus, whose poems he edited and also translated in the original metres; while his *Commentary on Catullus* (1876, 2nd ed. 1889) ranks as the highest authority on its subject. He died at Oxford, Oct. 9, 1913.

Ellis Island. Island with an area of 27½ acres in Upper New York Bay, U.S.A. It was a headquarters of the immigration and naturalisation service of the U.S. department of labour during 1892–1954. Here immigrants of dubious status were held while the authorities investigated their situation in relation to immigration regulations.

Elliston, ROBERT WILLIAM (1774–1831). British actor and theatrical manager. Born in London, April 7, 1774, the son of a watchmaker, and educated at St. Paul's School, he made his first appearance at Bath, as Tressel in *Richard III*. On Aug. 29, 1796, he played Sir Edward Mortimer in a revival of George Colman's *The Iron Chest* at The Haymarket. He made his début at Drury Lane, Sept. 20, 1804, succeeding Kemble as Rolla in *Pizarro*, continued a member of the company till 1809, rejoined it for 1812–15, and was lessee of the theatre 1819–26, when he retired bankrupt. He afterwards became lessee of the Surrey Theatre, where he played until within a fortnight of his death on July 8, 1831. Both as tragedian and as comedian Elliston was considered outstanding.

Ellora. Ruined town of India, in Bombay (until 1956 in Hyderabad) 13 m. N.W. of Aurangabad. It is famous for the Kailas temple, 8th cent., and for its rock temples and caves dating from the 5th to the 9th or 10th cent. These caves cover the face of a hill for 1½ m. and belong to three groups—Buddhist, 12 caves, Brahminical, 17, and Jain, 5. See illus. p. 1871.

Ellore OR ELURU. Town of Andhra Union, India, capital of W. Godavari dist. It stands near Colair Lake, is noted for its carpets, and has a large trade in grain. Pop. (1951) 87,213.

Ellsworth, LINCOLN (1880–1951). American explorer. Educated at Columbia and Yale universities, he held a number of engineering appointments in the U.S.A. and Canada until 1924, when he organized a geological expedition to the Andes. In 1925 he was commander and navigator of the Amundsen-Ellsworth polar expedition and in 1926 joint leader of the Amundsen-Ellsworth-Nobile transpolar flight from Spitsbergen to Alaska. He was scientific director of the Wilkins-Ellsworth trans-Arctic submarine expedition of 1931, and in 1935 flew 2,000 miles across the Antarctic, claiming 300,000 sq. m. of territory for the U.S.A. He died May 26, 1951. He received awards from foreign governments and scientific societies. He published *Our Polar Flight* (1925); *First Crossing of the Polar Sea* (1926); *Beyond the Horizon* (1938). See *Antarctic Exploration*; *Arctic Exploration*.

Ellwood, THOMAS (1639–1714). English author and Quaker. He was born at Crowell, Oxon, and became a Quaker in 1659, a conversion which cost him several terms of imprisonment. He became companion and reader to Milton after the latter lost his sight, and suggested to him the idea of *Paradise Regained*. He assisted George Fox in the dissemination of his principles. Ellwood's most important work is his autobiography, which was finished by Joseph Wyceth and published in 1714; new ed. 1900. He died March 1, 1714.

Elm (*Ulmus*).

A native tree of Great Britain, of the family Ulmaceae. More frequently found in avenues, parks, and hedges than in woods and forests, elms flourish in any soil, but to attain to their full height of 80 ft. or thereabouts, and to make the best wood, require a rich alluvial loam. The most familiar species are wych elm (*U. montana*) and bell elm (*U. campestris*). Both may be planted



Elm tree in full foliage. It is a comparatively shallow rooting tree

F. R. Hinkins

in open weather at any time between autumn and spring. The usual way of increasing in private



Elm. Leaves and flowers of common elm

gardens is by layering, or in the case of the bell elm by removal of suckers, as this tree seeds scantily. Elms should not be planted near dwelling-houses, as the timber has a tendency to decay inwardly, involving

danger of the limbs dropping off suddenly, without any warning, especially in high winds.

Elman, MISCHA (b. 1891). Russian violinist. Born at Talnoi, Russia, Jan. 20, 1891, he received his musical education at Odessa and under Cui at St. Petersburg (Leningrad). He made his début there in 1904, afterwards appearing in Berlin, Dresden, and elsewhere. His first appearance in London took place March 21, 1905; in New York in 1908. From the first he was recognized as one of the world's greatest violinists. He later resided chiefly in the U.S.A.

Elmet. Name of a small ancient British kingdom. It existed in the 6th century and earlier, but was ended when conquered by Edwin, king of Northumbria, about 617. It roughly corresponded to the West Riding of Yorks. The name was long preserved by the forest of Elmet and exists in Barwick-in-Elmet and Sherburn-in-Elmet, both near Leeds.

Elmina OR ST. GEORGE DEL MINA. Small port of Ghana (Gold Coast), 8 m. W.S.W. of Cape Coast Castle. It was the first lasting European settlement on that coast. Here is a castle, built by the Portuguese in 1482 and succeeding years, taken by the Dutch in 1637, and transferred to the British in 1872.

Elmira. City of New York, U.S.A., the co. seat of Chemung co. On the Chemung river, 145 m. S.E. of Buffalo, it is served by several rlys. It contains the state reformatory for male offenders between 16 and 30. Elmira College for women, 1855, was the earliest U.S. college to give women degrees comparable with those for men. A busy rly. and industrial centre, Elmira makes bridges, office equipment, boilers, valves, leather and knitted goods. Settled in 1788, it

was incorporated in 1828 and received a city charter in 1864. Mark Twain wrote much and is buried here. Pop. (1950) 49,716.

El Misti. Volcanic mt. of Peru in the prov. of Arequipa, by which name the mt. itself is sometimes called. It is a few miles N.E. of Arequipa city. Alt. 20,000 ft.

Elmore Process. Method of making seamless copper (or other metal) tubes by depositing the metal by electrolytic action on a bar or mandrel kept rotating in the electric bath. It was devised by J. O. S. Elmore, an engineer in India, in 1896. A tube so formed would be wanting in mechanical strength if the deposition only were depended upon. Elmore therefore compacted the tube as the deposition of metal proceeded by rotating the mandrel against an agate burnisher, and thus greatly increased its strength. The advantage of the process lies in the purity of the product and the elimination of smelting processes.

Elmshorn. Town of Schleswig-Holstein, Germany. It stands on the Krüchau, about 10 m. from its junction with the Elbe and 23 m. N.W. of Hamburg. It is a river port. Pop. (est.) 16,000.

Elmsley, PETER (1773-1825). British scholar. Educated at Westminster School and Christ Church, Oxford, he showed a remarkable aptitude for study. He was ordained, but devoted most of his time to the study of the classics and won a reputation throughout Europe by his critical work on the Greek tragedians. He wrote for the Edinburgh Review and the Quarterly Review. In 1823 he became principal of St. Alban Hall and Camden professor of ancient history at Oxford. He died March 8, 1825.

Elmslie, WILLIAM GRAY (1848-89). British divine. Born at Insch, Aberdeenshire, Oct. 5, 1848, he was educated at Aberdeen university and New College, Edinburgh, and later studied in Germany. In 1873 he became assistant to Dr. J. Oswald Dykes, at Regent's Square Presbyterian church, London, and was chosen minister of Willesden Presbyterian church in 1875. In 1880 he was appointed tutor of Hebrew in the Presbyterian College, London, being elected to the professorship of Hebrew and O.T. literature in 1883. He died Nov. 16, 1889.

His son, William Alexander Leslie (b. 1885), a distinguished Oriental scholar, clergyman, and professor, wrote *Aboda Zara* or *The Mishna on Idolatry*, 1911, and *Studies in Life from Jewish Pro-*

verbs, 1917. He became principal of Westminster College, Cambridge, in 1935.

Elobey. Two small islands, called Great and Little, off the mouth of the Gabun river, W. coast of Africa, belonging to Spain. Great Elobey is covered with bush, and has an area of $\frac{1}{2}$ sq. m. The area of Little Elobey is 22 acres. The islands are under the control of a sub-governor, who is responsible to the governor-general resident at Santa Isabel on the island of Fernando Po. The inhabitants are mostly of the Benga tribe.

Elocution (Lat. *eloqui*, to speak out). The art of effective public speaking. In classical times it included oratory, but now refers solely to the method and manner of delivery, the right study of which includes breath control, voice production, articulation, pronunciation, and expression.

Breath is the motive power of the voice. Authorities agree that the intercostal diaphragmatic method of breathing, i.e. the free expansion laterally of the lungs at their base and the descent of the diaphragm in inspiration and the reverse action with an even abdominal pressure in expiration—inhalation quickly and silently and exhaling slowly and evenly—gives a maximum of breath with a minimum of exertion. There should always be a supply of breath in the lungs, and inspiration should be renewed well before expiration is accomplished. A speaker's words should be poised on the breath, for any escape through or between the words will cause loss of tone and power and, under continuous strain of public work, may lead to permanent injury of the voice. An open throat, a mobile jaw, muscular control of the tongue and soft palate, together with right control of the breath, are the keynotes of correct voice production.

A sense of rhythm and beauty of diction, with a distinctive delivery, is as essential in the speaking of modern, as in that of classical, selections. Enunciation is the medium for expressive pronunciation, clearness of articulation being of the greatest importance. The tongue, hard and soft palate, gums, teeth, and lips all constitute part of the articulating organs, and by their partial or complete contact the consonants are formed. Vowels, being purely vocal, are produced by the changing shape of the mouth cavity and varying positions of the tongue. Pace must be varied according to the different emotions expressed. Emphasis is

used principally to mark the salient word or words of a sentence, so as clearly to define the meaning. Its too frequent use negatives its own value, and over-emphasis is an offence to the intelligence. Pauses facilitate proper phrasing, and at the same time permit the reciter to take breath; the rhetorical pause, in which the breath is suspended, is used to emphasise some special effect. Tone should illumine and colour the words so that the full beauty of the theme is expressed.

Elohism. Term used in Biblical criticism to denote the writer of one of the documents used in the compilation of the Pentateuch, or rather the Hexateuch. This is called the Elohist document, because the writer uses consistently the name *Elohim* for the God of the Hebrews, whereas the writer of another document (the Jehovistic) employs with equal consistency the divine name *Jehovah*.

Elongation. In astronomy, the angle subtended at the earth between a planet and the sun. For Mercury it varies between 0° and 28° (greatest elongation) as the planet revolves in its orbit; for Venus between 0° and 48° . These planets are therefore always seen close to the sun, *i.e.* as morning or evening stars. For the outer planets the elongation can have any value from 0° to 180° , and they are therefore visible from time to time at all hours of the night.

Elongation. In metallurgy, the degree of permanent extension in a test piece of standard dimension before fracture takes place under the action of tensile stresses. It is invariably expressed as a percentage of the original gauge length marked off on the test piece. As so defined, elongation is the sum of two separate and measurable elongations, one being a general extension over the whole of the parallel part of the specimen, and the second a local extension taking place at the point of fracture. The first increases with the applied load and varies directly with the gauge length, while the local extension varies with the cross-sectional area and is independent of the gauge length. This implies that as the gauge length becomes shorter the effect of this local extension upon the extension as a whole becomes greater, so that the gauge must bear a certain relation to the cross-sectional area of the test specimen.

Elopement. Name given to the secret flight of a pair of lovers, generally with the object of mar-

riage. Unless abduction can be proved it is not an offence against the law. *See* Abduction.

El Paso. City of Texas, U.S.A., the county seat of El Paso co. The largest city on the Mexican border, a favourite health resort, and a port of entry, it stands 3,760 ft. above sea level on the Rio Grande, which separates the state from Mexico. Situated opposite Ciudad Juarez, it is served by several rlys. El Paso processes copper, lead, and silver ores, refines petroleum, and ships oil, ores, livestock, wool, hides, cotton, and farm produce. It has saw mills, cotton mills, machine shops, and flour mills. The area is to benefit from Elephant Butte dam, on the Rio Grande, 120 m. to the N. El Paso was named from its situation in a rift in the mountains, and was settled in 1827, being incorporated as a town in 1875. English and Spanish are spoken in the city, 60 p.c. of whose inhabitants are of Mexican blood and whose architecture is largely Spanish. Fort Bliss, the largest U.S. cavalry post, is here. Pop. (1950) 130,485.

Elphinstone, MOUNTSTUART (1779-1859). British administrator. Born Oct. 6, 1779, the fourth son of the 11th Baron Elphinstone, he entered the Bengal civil service in 1796. Appointed resident at Nagpur in 1804, he was sent as envoy to Kabul in 1808, and was resident at Poona in 1811-17, and commissioner after its annexation. During 1819-27 he was governor of Bombay. He returned to England in 1829 and lived in retirement, twice refusing the governor-generalship of India, and died Nov. 20, 1859. Elphinstone compiled the famous legal code known by his name, and virtually founded the system of state education in India. Elphinstone College, Bombay, was endowed by the natives as a memorial to his administration. He wrote a valuable account of the Kingdom of Cabul and its Dependencies, 1815; and a History of India, 1841. His own life was written by J. S. Cotton, 1892.

Elphinstone, WILLIAM (1431-1514). Scottish prelate. A native of Glasgow, he attended its university, of which he became rector in 1474. He was made

bishop of Ross in 1481, and nominated to the see of Aberdeen in 1483. In 1488 he was appointed lord chancellor and lord privy seal in 1492. In 1494 he established King's College, the original foundation of Aberdeen university, appointing Bocce (*q.v.*) first rector and securing grants from James IV for its maintenance. He introduced the printing press into Scotland, 1507. He died at Edinburgh, Oct. 25, 1514, it is said through grief over the battle of Flodden.

Elsie Venner. Novel by Oliver Wendell Holmes. After serial publication in the Atlantic Monthly under the title of The Professor's Story, the novel was published in volume form in 1861 as Elsie Venner: a Romance of Destiny. Its theme is the possible effect of antenatal influence upon individual conduct. A mother is bitten by a rattlesnake shortly before giving birth to her child. The romance shows Elsie Venner's whole life and character affected by that pre-natal poisoning, since her nature turns out to be half that of a snake.

Elsinore (Dan. *Helsingør*). Seaport in Denmark. In the dist. of Frederiksborg and on the island of Zealand, it stands on The Sound, and has ferry communication with Helsingborg on the Swedish coast, and connexion by rly. with Copenhagen, 25 m. S. Shipbuilding is the principal occupation, and iron-founding, engineering, and agriculture are carried on. The place is the scene of Shakespeare's Hamlet. Pop. 15,841.

Elster. Name of two rivers of Germany, the Schwarze (black) and Weisse (white). The former rises in the mountains between Saxony and Bohemia and flows mainly N. until it falls into the Elbe 10 m. above Wittenberg. Its length is 110 m. The white Elster rises near Cheb in the Elstergebirge in Bohemia, but most of its course is in Saxony. It falls into the Saale in two branches, one near Halle and the other near Merseburg. It flows past Plauen and Leitz, and past Leipzig, where the Pleisse joins it. Its length is 120 m. The town and watering-place of Elster stands on the white Elster near the Bohemian border. The Elstergebirge is a range of mountains in Bohemia. It runs from the Erzgebirge to the Fichtelgebirge, and reaches a height of 2,630 ft.

Elstow (formerly Helenstow). Parish and village of Bedfordshire, England. It is 1 m. S. of Bedford, and is noted as the birthplace of



Mountstuart Elphinstone, British administrator
From a portrait in the British Museum

John Bunyan (*q.v.*). The church, restored 1880, includes early Norman work.

Elstree. Rural dist., parish, and village of Herts, England. It has a railway station, 7 m. S. of St. Albans. The church of S. Nicolas was rebuilt in the 19th century. Here are paper mills and a large reservoir. Film studios are at Boreham Wood near by. Pop. (rural dist., 1951) 14,757.

Elswick. District of Newcastle-upon-Tyne, England, including a ward in the W. of that county borough, and having a railway station. Here are extensive works of Vickers-Armstrong, Ltd. During both Great Wars vast quantities of munitions of war were manufactured here. Elswick Park was opened as a public recreation ground in 1878.

El Teb, BATTLE OF. Fought by the British, Feb. 29, 1884, against the Arabs. El Teb is a post in the Anglo-Egyptian Sudan, on the road from Trinkitat on the Red Sea to Tokar. In 1883 Osman Digna was besieging Tokar, and Valentine Baker, with a force of 4,000 men, was sent to relieve it. On Feb. 4, 1884, he was met by the tribesmen and was routed, two-thirds of his men being killed. Tokar then surrendered.

A British force of 4,400 men was then collected from Egypt and India, and under Sir G. Graham was landed at Suakin. On Feb. 29 this force faced the Arabs in their camp at El Teb. The latter threw themselves in wild fury against the British square, but after a fierce combat they were decisively beaten. The British casualties were 34 killed and 155 wounded, largely incurred in a charge made by the 10th and 19th Hussars.

Eltham. Parish of Kent, in the London bor. of Woolwich, 8 m. S.E. of London Bridge by electrified rly. Once a marketing town, it contained a palace, the fine banqueting hall of which still remains. Well Hall, an Elizabethan mansion, is supposed to have been occupied by Sir Thomas More's daughter. The Tudor outbuilding was restored in 1935 and is now used as an art gallery and restaurant. Eltham has many open spaces, including Eltham Common,

Avery Hill, and Well Hall Pleasaunce. Pop. 28,308.

Eltham Palace was built towards the end of the 13th century. It owes its origin to Anthony Bee, bishop of Durham, who appears to have lived here c. 1296-1311. At first a fortified manor house, it was subsequently converted into a royal residence. The great hall and part of the old kitchens adjoining are fine examples of domestic architecture of the reign of Edward IV. The 15th century bridge across the moat, which still remains, led by way of a gatehouse to a large court. The architecture of the palace is notable for the fine oriel windows, the open timber roof of the hall, and the gables, with beautifully carved barge boards, of the kitchens. In 1933 Stephen Courtauld was granted a 99 years' crown lease of Eltham Palace on condition that he restored the buildings, demolished the haphazard additions, and built a new house on approved plans. In 1945 he surrendered his lease and on Sept. 26 Lord Nathan, under-secretary for War, opened Eltham Palace as a training college for the Royal Army Educational Corps.

Eltham. Township of North Island, New Zealand. It is on the main line from Wellington to New Plymouth, from which it is 36 m. S. The chief centre of the Taranaki district, it has an extensive dairy-farming industry. Pop. 1,880.

Elton OR YELTON. Salt lake of Russia, in the region of Stalingrad. It lies on the border of the Kirghiz Steppes, 60 m. E. of the Volga. Area, 60 sq. m. Although it receives the waters of several streams and has no outlet, it is very shallow, and strongly impregnated with salt, thousands of tons being extracted from it yearly. The Kalmucks call it the lake of gold.

Elton, GODFREY ELTON, 1ST BARON (b. 1892). British political writer. Born March 29, 1892, he

was educated at Rugby and Balliol College, Oxford, and at Queen's College became lecturer in



Lord Elton.
British political
writer

modern history, 1919-39. An admirer of Ramsay MacDonald (whose Life he wrote, first vol. 1939), he was expelled from the Labour party in 1931 for support of that statesman at the time of the formation of the National government. The following year he became editor of the National Labour party's official organ, The News-Letter, a post he retained until 1938. He was raised to the peerage as Lord Elton of Headington in 1934. His publications include verse, essays, and political writings. A frequent broadcaster, he served on numerous committees, e.g. Ullswater Committee on broadcasting, 1935; Road Accidents Emergency Council, 1936-41.

Elul. The sixth month of the sacred and twelfth month of the civil year of the Jews, corresponding approximately to Aug.-Sept. It is mentioned in the book of Nehemiah. See Calendar.

Elutriation (Lat. *elutriare*, to wash out). Process of obtaining mineral substances in a finely powdered condition by diffusing them in water after they have been ground or crushed. In an elutriator the coarser particles rapidly subside, and the water which still holds the finer particles in suspension is decanted into another vessel and the powder allowed to settle. The process is used for obtaining emery of different grades of fineness, for preparing jewellers' rouge, and other fine sizing processes.

Eluvial Deposits. Term used in mining geology for natural mineral concentrations formed, without stream action, upon hill slopes as a result of weathering of metalliferous lodes or rocks that outcrop above them. The heavier and more resistant minerals collect just below the primary source; while the lighter minerals are further removed by the action of rain or wind. This type of natural concentration is not so efficient as that brought about by stream action (see Fluvial Deposits); consequently the primary source must generally be fairly rich itself to give rise to economic residuals.



Eltham, Kent. Exterior of the banqueting hall of Eltham Palace, built in the days of Edward IV

The most important eluvial deposits are of gold, tin, and columbite-tantalite. Gold eluvials are found in Australia, New Zealand, East and West Africa, and the U.S.A. Deposits in Malaysia, Belgian Congo, Australia, and Nigeria are notable contributors to the tin production, whilst those of Nigeria contain columbite-tantalite and occasionally smaller amounts of wolfram. Minor deposits of manganese, kyanite, barite, and gemstones may occur as eluvial deposits.

Elvan. Term applied by the Cornish miner and quarryman to any hard rock not typically granite. Whereas it generally refers to dykes of quartz- or granite-porphry, hard epidiorite may be called blue elvan. The porphyries of Cornwall are late granitic injections into the main granite, generally in the form of steeply dipping sheet-like bodies many yards in width. Although similar to granite in mineralogy and chemical composition, they have a different texture. They have relatively large crystals of quartz (quartz-porphry) or of the other essential mineral constituents of granite (granite-porphry) set in a fine-grained matrix of quartz, feldspar, and mica.

Elvas. Frontier city of Portugal, in Portalegre dist. It stands on an affluent of the Guadiana, 170 m. E. of Lisbon and 10 m. W. of Badajoz, on the Lisbon-Madrid rly. It has a Gothic cathedral, a 15th century aqueduct 4 m. long, a Roman castle, and an arsenal. The manufactures include pottery and brandy. The Roman Alpesa or Helvas and the Moorish Balesh, Elvas is an historic place; it held out against the Spanish in 1658 and 1711, but fell to the French in 1808. Pop. 11,747.

Elver. Young eel, the stages of whose life history are described under Eel.

Elverum. Town in Norway, at the entrance to the Østerdal, the most eastern of the great Norwegian valleys, and an important junction on the Oslo-Trondheim rly. On April 11, 1940, King Haakon removed from Hamar to Elverum in face of the German invaders, and a few days later the town was reduced to ruins by

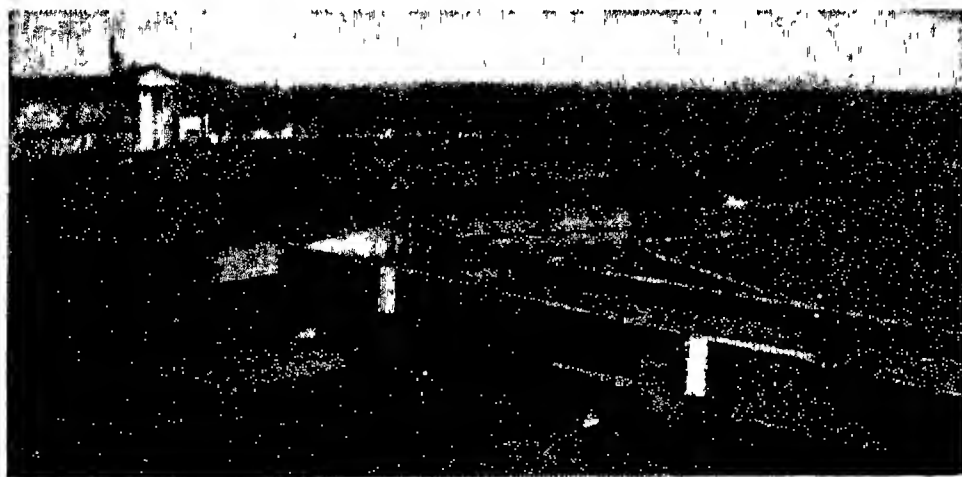
aerial bombardment after his refusal to hand Norway over to German control. King Haakon was not injured, and later escaped to Great Britain, but some of his party were killed by machine-gun fire.

Elvey, SIR GEORGE JOB (1816-93). British organist and composer. Born at Canterbury, March 27, 1816, he became a chorister at the cathedral and a pupil of the organist. He was organist of S. George's chapel, Windsor, 1835-82. He was knighted in 1871, and died Dec. 9, 1893. Elvey's compositions are chiefly church music; he composed the tune of Come, Ye Thankful People.

Elvey, MAURICE. Professional name of William Seward Folkard (b. 1887). British actor and stage and film director. He was born in Yorkshire, Nov. 11, 1887. In 1912 he was engaged by Granville-Barker as stage director in America for the production of Fanny's First Play. He returned to England and devoted himself exclusively to film production (over 150 films after 1918). He was director of productions to



Sir George Elvey,
British organist



Elvas. Fortifications of the city defending the Spanish frontier of Portugal

Julius Hagen and president of the British Association of Film Directors. He also made pictures in France, Germany, and Hollywood.

Elvira, COUNCIL OF. Ecclesiastical assembly held at Elvira in Granada, early in the 4th century. It was attended by nineteen bishops, and put forth about eighty canons dealing with church discipline. It forbade the veneration of pictures in churches, ordered attendance at mass on Sundays, and enjoined celibacy on the clergy.

Elwes, GERVASE CARY (1866-1921). British singer. Born at Billing Hall, Northampton, Nov.

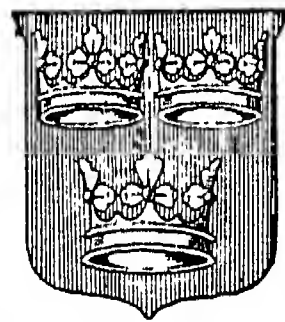
15, 1866, he was educated at the Oratory School, Birmingham, and Christ Church, Oxford. He abandoned a diplomatic career for singing, and appeared as a professional tenor at Kendal in 1903, and in London with the Handel Society. Possessing superb diction, he sang with great success in oratorio, but more especially in *Lieder*. He appeared regularly at promenade concerts and gave recitals with Fanny Davies (*q.v.*) in Germany. He died at Boston, Jan. 12, 1921, as the result of a train accident during a concert tour. A fund to assist young musicians commemorates him.

His son Simon (b. June 29, 1902) studied at the Slade School, and became a portrait painter, exhibiting regularly at the R.A., becoming A.R.A. 1956.

Elwes, JOHN (1714-89). British miser. Born April 7, 1714, son of Robert Meggott, on succeeding to the estate of his uncle, Sir Hervey Elwes, he assumed his name. The estate having been much encumbered, habits of frugality had turned Sir Hervey into a miser, and John Elwes proved an apt pupil. Good-hearted by nature, he was kindly to all but himself. He lent money to fellow members when M.P. for Berkshire, 1772-84. After a life of the utmost penury, he died Nov. 26, 1789. He left over £500,000.

Ely. Episcopal city, urban dist., and market town of Cambridgeshire, England. It stands on an eminence on the left bank of the Ouse, in the Isle of Ely—which ranks as a separate administrative county, and forms a county constituency—16 m. N.N.E. of Cambridge. It is famous for its magnificent cathedral. In 673 Etheldreda founded a monastery here for monks and nuns, and became first abbess. It was destroyed by the Danes in 870, and in 970 was refounded as a monastery by Ethelwold, bishop of Winchester.

The present cathedral was begun by Abbot Simeon in 1083. It embraces every style of architecture from Early Norman to Late Perpendicular. It is 537 ft. long and 189 ft. across the great transepts. The W. portion of the nave and W. tower were added in 1180; the fine Galilee or W. porch was completed about the beginning of the 13th century; the choir was



Ely. Arms of
the bishop



Ely. The cathedral viewed from the west. The 12th century west tower and Galilee porch; to the right, the south-west transept and tower, of Transitional Norman architecture

Photochrom

erected between 1235-52; the beautiful Decorated octagon tower and lantern (170 ft. high), finished in 1328, took the place of the central tower, which collapsed six years earlier; the lady chapel (now the parish church) dates from 1321-49. Since 1845 the edifice has undergone restoration. Within the precincts are the Tudor bishop's palace, the King's School (1541), and a theological college. Ely became a bishopric 1109. Market day, Thurs. Pop. (1951) urb. dist. 9,989; Isle of Ely, 89,038.

Ely, MARQUESS OF. Irish title borne since 1800 by the family of Loftus. In 1771 Henry Loftus, an Irish landowner, was made earl of Ely, taking his title from Ely in Fermanagh. The title died with him in 1783, but his nephew, Sir Charles Tottenham, Bart., inherited his estates and took the name of Loftus. He was postmaster-general and was made a baron in 1785. Other Irish honours followed, cul-

minating in a marquessate in 1800, the reward for his support of the union of 1801, when he was made a baron of the United Kingdom.

Elyot, SIR THOMAS (c. 1490-1546). English diplomatist and scholar. A native of Wiltshire, he was knighted by Henry VIII and sent on several embassies. His most famous work is *The Book named The Governor*, 1531, the first on the subject of education written and printed in the English language (*consult* edn. H. H. S. Croft, 1880). He also compiled a Latin-English dictionary 1538. He died March 26, 1546.

Ely Place. Cul-de-sac near Holborn Circus, London, E.C. It occupies part of the site of Ely House,

the inn or hostel of the bishops of Ely, of which the church of S. Etheldreda, restored to Roman Catholic worship in 1874, was the chapel. One of the most perfect examples of Decorated architecture in England, it has windows E. and W. with exquisite tracery, and an unrestored crypt; it was reopened July 2, 1952, after repair of war damage. John of Gaunt died in Ely House in 1399, and Henry VIII is said to have first met Cranmer here. It was demised to the crown under Elizabeth I, and transferred to Sir C. Hatton.

Elyria. City of Ohio, U.S.A., the co. seat of Lorain co. On the Black river, 25 m. W. by S. of Cleveland, it is served by rlys. and an airport. It makes machinery, foundry and machine shop products, steel tubing, air brakes for cars, bicycles, heating and air conditioning units, furniture, leather goods, hosiery, and lace. Settled in 1817, it became a city in 1892. Pop. (1950) 30,307.

Elysée. Palace in Paris, the official residence of the president of the French republic, in the Faubourg St. Honoré. A garden separates it from the Champs Elysées. It was built in 1718 for the comte d'Evreux, but passed later into royal hands, and was the residence of Madame de Pompadour. Others who lived here included Napoleon I and Napoleon III. After 1870 it became the official residence of the president.

Elysium OR THE ELYSIAN FIELDS. In classical mythology, the abode of the souls of the good after death. Some legends make Elysium a part of the underworld, others make it an island or islands in the Atlantic Ocean—the Fortunate Islands or Isles of the Blessed. Elysium is represented as a place of perpetual sunshine with flowery meadows and pleasant streams.

Elytra (Gr. *elytron*, covering, sheath). Horny sheaths or cases into which the fore wings have been modified in the beetles and certain other insects. They usually cover the back of the insect, and the hind wings are folded under them. *See* Insects.

Elze, FRIEDRICH KARL (1821-89). German student and critic. Born at Dessau, Anhalt, May 22, 1821, he studied at Leipzig and Berlin. Having published a life of Byron (1870), Eng. trans. 1872, and various works on the Elizabethan drama, he was appointed to the chair of English literature at Halle in 1875. His best known work is a biography of William Shakespeare (1876), Eng. trans. 1888. He died at Halle, Jan. 21, 1889.



Sir Thomas Elyot, English diplomatist

After Holbein

Elzevir. Name of a family of Dutch printers which is given also to some famous books printed by them, *e.g.* pocket editions of the Greek Testament, Latin and Italian classics, and French memoirs. The firm, founded at Leyden in 1583 by Louis Elzevir (1540-1617), was carried on at Amsterdam by the family, 1638-80, and ended in 1712. The first edition of the Caesar of 1635 is its acknowledged masterpiece in type, ornaments, paper, printing, and purity of text. The publications of the firm dated 1626-80 are generally the most valuable. More than 150 spurious Elzevirs are known to experts. A fount of type has been given the name Elzevir.

Emanation (Lat. *emanare*, to flow out). In philosophy, the theory that all things proceed from a higher original principle (as light proceeds from the sun), into which they are again absorbed. This form of pantheism, of eastern origin, was adopted by the neo-Platonists and developed by the Gnostics and Cabbalists.

For radium emanation see radon.

Emancipation of Slaves. See under Slavery.

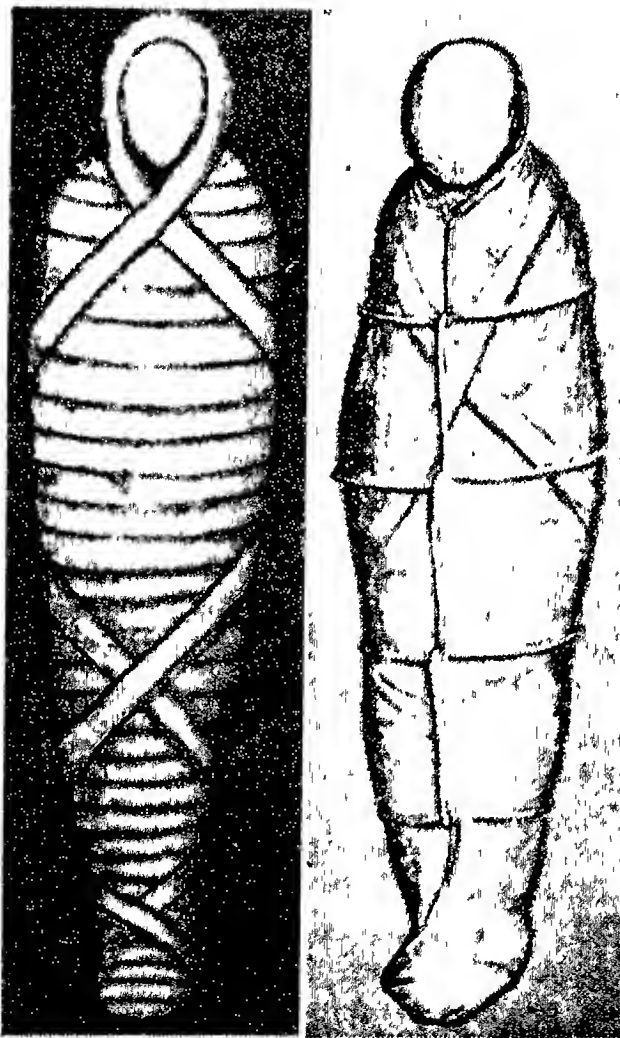
Emanuel I (1469-1521). King of Portugal. Born May 31, 1469, he ascended the throne in 1495. He inspired the expeditions of Vasco da Gama, Albuquerque, and Cabral to Brazil, Goa, Malacca, and Sumatra. Under his guidance Portugal became the principal maritime power in the world. He was a persecutor of Jews and a founder of churches and monasteries. He died Dec. 13, 1521.

Emanuel, WALTER LEWIS (1869-1915). British humorous writer. Born April 2, 1869, in London, he was educated at University College School and Heidelberg, and became a solicitor in 1896. In 1902 he began writing for Punch his amusing comment on current news entitled *Charivaria*, which he continued regularly for the rest of his life. He died Aug. 4, 1915. He published *A Dog Day*, 1902; *The Dogs of War*, 1906; *One Hundred Years Hence*, 1911.

Embalming (Fr. *em*, in; *baume*, Gr. *balsamon*, balm). Art of preserving dead bodies. Among the ancient Egyptians, and possibly the ancient Peruvians, the custom originated in a belief that the soul after death would return and be reunited with the body; every means was therefore used to keep the body as lifelike as possible. For long after the introduction of mummification in the Old kingdom or earlier, only kings and nobles

could expect this favour, but cheaper and simpler methods were evolved whereby the middle class, and eventually even the poor, could obtain immortality.

Herodotus (II, 86-8) describes three methods of differing cost in use in his day; each involved steeping in natron for 70 days. Chemical analysis of extant mummies does not bear out his account in all details, but the general method is clear. The body was usually, though not always, eviscerated (the vital organs preserved separately in Canopic jars, *q.v.*). It was then dessicated by packing in dry natron, probably for 40 not 70 days (cf. Gen. 50, v. 3), and then washed and ceremonially lustrated with a natron solution, anointed with oil, myrrh, and spices, and the thorax and abdomen packed with resin and sawdust, linen or lichen. Incisions were sealed with beeswax and the whole body often drenched with resin before the elaborate covering of bandages incorporating the appropriate amulets and spells was applied. The wrapped mummy would then be covered with painted cartonnage and enclosed in a coffin or series of coffins and a



Embalming. Left, inner and, right, outer bandages wrapped by the ancient Egyptians round an embalmed body or mummy

sarcophagus. The Egyptians in the late period also embalmed cats, crocodiles, ibis, hawks, and other sacred animals; a papyrus relates to the embalmment of the sacred bulls of Apis.

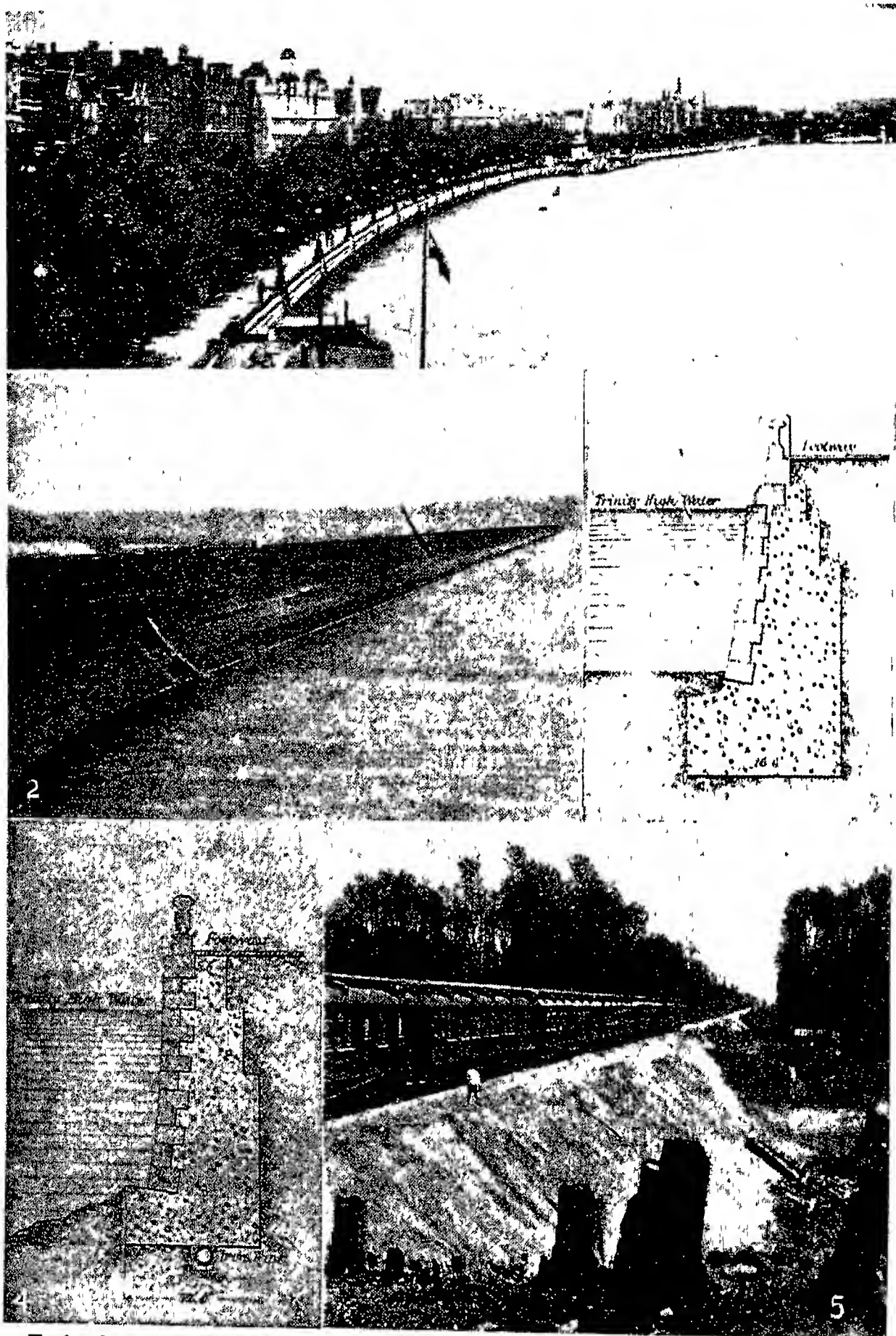
The ancient Persians apparently embalmed with wax, the Assyrians with honey, the Guanches (abori-

gines of the Canary Islands) in the Egyptian manner. Embalming has long been practised in Europe and is fairly common in the U.S.A. Modern examples of the embalmer's craft are the bodies of Lenin and Stalin preserved for perpetual public display in Moscow, said to have been treated by a secret process. Consult *The Royal Mummies*, G. Elliot Smith, 1912; *The Mummy*, E. A. T. Wallis Budge, 1925; *Ancient Egyptian Materials and Industries*, A. Lucas, 1948.

Embankment. Mound of loose material artificially formed, or a bank supported by artificial means. There are (a) embankments formed simply by tipping material and allowing the sides to assume the natural angle of repose of the material of which they consist, as in rly. embankments; (b) reservoir embankments for containing and resisting the pressure of water; (c) embankments of earth or similar material retained, supported, and protected by walls, sheet piling, or other means.

Rly. embankments, for the most part of materials excavated in cuttings, serve to carry a rly. across a valley or depression, to avoid steep gradients; they are also constructed to raise the level of rlys. across wide plains, especially where the soil becomes waterlogged, the necessary materials being obtained by excavating material from borrow pits on either side of the line. Along the side of a hill they are usually formed from material from a side excavation, the sloping ground under the bank being first cut into steps to prevent side-slipping of the deposited material. Broken stone, gravel, and good sand are the best materials; wet clay and surface soil are liable to cause trouble and expense, as the initial angle of repose may become much flatter, and slips may occur. An embankment should be made higher than its permanent level to allow for subsidence; the allowance varies from $\frac{1}{2}$ to $\frac{1}{3}$ of the height. Tipping should always proceed in a forward direction.

In first-class work the slopes are finally covered with surface soil for a depth of a few inches and either turfed or sown with grass seed, as grass binds the surface and tends to prevent washing away by rain. Embankments in still water should have their slopes pitched with stone; if they have to withstand the action of waves or currents of water they should consist of rubble or be contained by walls.



Embankment. 1. Thames Embankment, London, looking E. from Waterloo Bridge. 2. Embankment at Belvide reservoir, Staffordshire. 3. Sectional diagram of Thames Embankment at Lambeth, and, 4, at Chelsea. 5. Embankment on the National Transcontinental Rly. at James Bay, Canada

The angle of repose varies with different materials from 14° to 37° : the range for materials usually employed is from 26° to 34° . Owing to the steeper gradients permissible, road embankments are not often necessary on a big scale, but, where constructed, the same rules apply as to railway embankments.

Reservoir embankments consist of earth or similar material lined inside with concrete or stone and rendered watertight by a vertical wall of clay puddle in the centre of the bank, extending from a foundation of impervious material to well above water level. Such embankments have to sustain the side pressure of the impounded water, and are made with slopes much flatter than the natural angle of repose.

A wharf contained by sheet piling with earth filling, or the protection or reclamation of a foreshore or

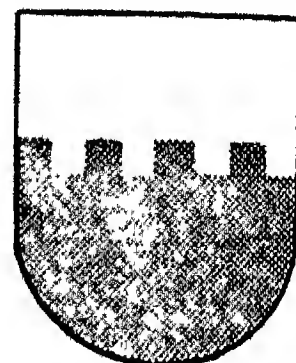
riparian land by a wall, may constitute an embankment. The term is popularly applied to riverside constructions whereby the banks are protected and retained by walls and have a road and footwalk sometimes ornamented with gardens.

Embargo (Spanish). Term in international law meaning a detention of merchant ships in port. It may be used in time of peace as a reprisal for some injury committed by the state to which the ships belong. A state, when war with another is imminent, may also lay an embargo on the ships of that other in its ports with a view to their seizure and confiscation should war break out. It is doubtful, however, whether such an anticipatory embargo is today recognized by international law.

The term is also used in a wider sense to mean any prohibition.

Embassy Theatre. London playhouse situated in Eton Avenue, Swiss Cottage, opened on Sept. 11, 1928, under the management of Herbert Jay and Sybil Arundale (*q.v.*). The first production was *The Yellow Streak*, and over a period of some 10 years a number of the plays performed there were subsequently transferred to West End theatres. The theatre, which has a seating capacity of nearly 700, was damaged by a German bomb in Oct., 1940, and was reopened in Feb., 1945.

Embattled, IMBATTLED, OR BATTLED. In heraldry, a line of division, or outline showing square projections like the crenellations or embrasures of a castle wall. The term crenelated is sometimes used.



Embattled in heraldry

Ember Days. In the Anglican and Roman Catholic Churches, fasts of the four seasons. They are the Wednesday, Friday, and Saturday after the 1st Sunday in Lent, Whitsunday, Sept. 14 (Holy Cross Day), and Dec. 13 (feast of S. Lucy). The weeks in which these days occur are called Ember Weeks. They were introduced into England by S. Gregory (590-604). Ordinations in the Anglican Church take place on the Sundays following the Ember Days, and in the R.C. Church on the Saturdays of the Ember Weeks.

Embezzlement. In English law, the wrongful appropriation to his own use, by a clerk or servant, of money received by him for his master. It must be distinguished from larceny by a servant. In the latter case the servant steals property which has been in his master's possession; in embezzlement he intercepts it. For example, if a shop assistant receives a shilling for goods sold and simply puts it in his pocket, and does not account for it to his master, it is embezzlement. If he puts it in the till, and then takes it out again and steals it, it is larceny by a servant.

Emblem (Gr. *emblēma*, an insertion). Originally meaning an ornament inserted on a mosaic or vase, the term is now generally used for an object or representation symbolic by reason of its connexion with another object, person, or event. It is also used for the marks used by printers to distinguish the work of their press.

In art the emblem has played an important part, especially in the representation of Christian saints, etc. The work of the old masters, and

the pages of old missals, Bibles, etc., are full of such representations. It has been estimated that the emblems of the saints number over 800, or, including variant forms, over 3,000.

Among the commonest are the keys of S. Peter, the sword of S. Paul, the spiked wheel of S. Catherine, the lamb of S. John Baptist, the lion of S. Jerome, the dragon of S. George, the X-shaped cross of S. Andrew, the serpent of S. Patrick, the arrows of S. Sebastian. For the most part these objects are emblematic of the death suffered by the saint, or of miracles attributed to him.

Emblems are also given to various virtues and religious conceptions, e.g. the hand, marked with a cross or sacred heart, is found to stand for labour; a globe, surmounted by a cross and resting on a heart, for the reign of love and concord on earth; a lily for purity and the Virgin Mary. The patriarchs, prophets, and sibyls have their emblems, as Adam with a spade, Moses with the tables of the law, David with harp or sling, or Sibylla Agrippina with a scourge. An early emblem of Christ was a fish, the letters of the Gr. *ichthus*, fish, standing for Jesus Christ Son of God the Saviour. During the 15th century, when heraldry was at its height, armorial bearings incorporating many emblems were devised for almost 100 saints. See Hagiology.

Emblements. Term used in English law for the common law right of a tenant whose tenancy is ended otherwise than by his own act to take the crops then growing on the land.

Embolism (Gr. *embolos*, stopper, plug). Obstruction of a blood-vessel by material which has been carried along in the blood-stream. The commonest cause of embolism is detachment of a blood-clot or portion of a blood-clot which has formed in a vein. Other substances which may form emboli are portions of growths on the heart-valves resulting from endocarditis, calcareous material from degenerated vessels, pieces of tumours, fat, masses of bacteria, and air bubbles.

Embolism of a coronary artery may cause sudden death; embolism of the brain may lead to paralysis; embolism affecting the main blood supply to a limb leads to sudden pain, swelling, and pulselessness, followed by gangrene in some cases and by recovery in others where other vessels enlarge and replace the blocked circulation. If the embolus contains in-

fective micro-organisms, as, for instance, when it has been broken off from a septic clot, the result is often to set up an abscess where it lodges. Air may accidentally find entrance into the blood-stream during operations involving the large veins of the neck or uterus. When the air bubbles reach the heart they cause an air lock and sudden death.

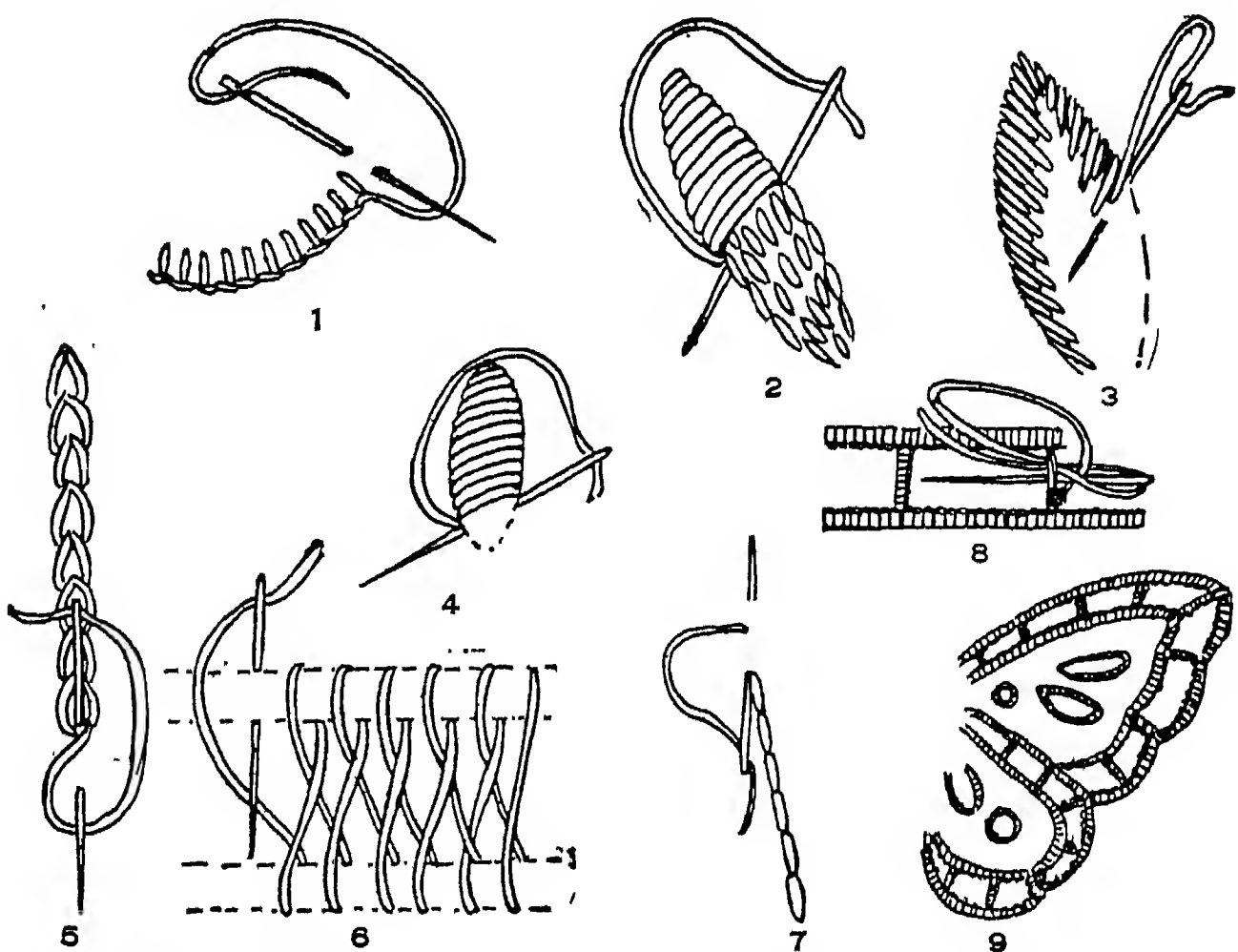
Embracery. In English law, an attempt, whether successful or not, to influence a jury in favour of one party to a trial, whether by promise, persuasion, monetary bribery, treating, or the like. The person who attempts to so influence a jury is called an embraceor; and the same term is applied to one who comes into court to overawe a jury, or for reward, and speaks in favour of one party. It is a misdemeanour punishable by fine and imprisonment. The word is derived from old Fr. *embracer* (mod. *embraser*), to set on fire, excite; to embrace, meaning to clasp in the arms, is from Fr. *em*, in; *bras*, arm (Lat. *bracchium*).

Embroidery. Art of decorating fabric by means of needle and thread. Its practice is of great antiquity; there are references to it in the description of the Tabernacle, and Ezekiel (27, v. 7) mentions "fine linen with brodered work from Egypt." Phrygia and ancient Babylon were renowned for their embroideries. The art was also well known in ancient Greece. In Christian times embroidery became the handmaid of the church. Some vestments still existing at Arles, France, date

from the 6th century. A very beautiful dalmatic in the Vatican, once reputed to be that of Charlemagne, is now attributed to the 11th century. A medieval embroidery that stands alone is the Bayeux Tapestry (*q.v.*).

In the 13th century English embroideries were without equal, and "Opus Anglicanum" was eagerly sought. Examples of magnificent early English copes are exhibited in Ascoli-Piceno, Pienza, Anagni, Madrid, Toledo, S. Kensington, and elsewhere. French and German embroidery reached a high pitch of excellence during the 13th and 14th centuries, as also did that of the Italian workshops in Milan and Florence.

In W. Europe, in the 16th century, embroidery was both a professional and an amateur handicraft. Elaborate embroidery was used for secular dresses and furniture, and panels and cushions were decorated with cross-stitch or *petit point*. Some magnificent bed-curtains ornamented with trees and large leaves full of elaborate detail were made in the Jacobean period, while embroideries of Charles I's time are characterised by the highly raised style aptly known as stump work. Simplicity marked the early 18th century embroidery, with its powderings of natural flowers worked in chain-stitch on a light ground, and many beautiful samplers of the period yet remain. Under the Hanoverian kings, the highly ornate dress afforded many opportunities for the art of the needle, and the upholstered chairs were covered



Embroidery. Stitches in common use. 1. Buttonhole. 2. Long and short stitches. 3 and 4. Satin. 5. Chain. 6. Eastern or Oriental. 7. Back stitch. 8. Working diagram of cut work shown complete in 9.

with cross- and tent-stitch work. Later the art sank low; copies in embroidery of black-and-white prints and of paintings became the fashion. In the second half of the 19th century the Pre-Raphaelite movement, the revelation of Japanese art, and the study of Eastern examples brought about a change of taste and an improvement in the style of embroidery.

Modern embroidery can be divided into two sections: machine embroidery and hand embroidery. Machine work is used principally for the adornment of dresses, lingerie, millinery, and furnishings. Various embroidery machines have been invented, the most popular being the single-needle type, similar to the ordinary sewing-machine. The first successful machine, invented by Josué Heilman of Mulhausen, was patented in England in 1829. On this machine it is possible for one person to guide from 80 to 140 needles working simultaneously and producing repeats of the one design. The Bonnaz machine, patented in Great Britain in 1868, does chain-stitch, braiding, and cording. As modified by M. E. Cornelly, it does in addition gimp and retard stitch.

Hand embroidery is of many different kinds. In appliqué work, one material is applied to another by means of fancy stitchery. There are two forms of this work, onlay and inlay. Assisi embroidery is a variation of cross-stitch embroidery; the design is outlined and the background is filled with crosses. Cross-stitch, tent-stitch, *petit point*, and *gros point* are usually worked on canvas.

Cut-work or Swiss embroidery, with open groundings such as Madeira, Renaissance, Richelieu, and Venetian embroidery, is used on fine cambric and linen. Drawn-thread work and needleweaving are of peasant origin; the threads of either the warp (or the weft) of the material are drawn, and the weft (or warp) threads are worked into a pattern. Florentine embroidery, of Italian origin, is composed of vertical zigzag lines of shaded stitches. Hardanger embroidery, the famous embroidery of Norway, is a mixture of satin-stitch and drawn-thread work. Jacobean embroidery is worked in wools, usually on stout twilled fabric suitable for panels and furnishings. This design gives scope for various fillings and shades of wool.

Metal-thread embroidery, used in the 17th and 18th centuries for the decoration of ecclesiastical

ornaments and vestments, now appears on official costumes and civil and military badges. The term *passementerie* covers the making of cords, fringes, tassels, and buttons for the trimming of dresses and for furnishings. Tambour or Luneville work—the attaching of beads, bugles, and sequins to materials by means of a hook—is done on an embroidery frame.

In quilting, two or three layers of material are held together by stitching in a decorative design. There are two kinds, English and Italian, the latter having a cord or wool inserted in the design to produce a pattern in relief. In England and Wales, quilting remains a national art.

Smocking is a method of gathering a width of material into regular folds which are secured by decorative stitchery. This is of peasant origin, and many beautiful specimens can be seen on Hungarian national costumes.

The names of the principal stitches used in hand embroidery are: stem, back, split, chain, cable, couching, herringbone, fishbone, buttonhole, satin, daisy, long and short, French knot, darning. See Needlework.

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Embrun. Town of France. It stands above the Durance in the department of Hautes Alpes, being nearly 3,000 ft. high, 27 m. by rly. S.S.W. of Briançon. Although a small place it has much historic interest. It was once the seat of an archbishop, and its magnificent cathedral, built in the 12th century, remains. Dedicated to Notre Dame, this has a fine tower. The palace of the archbishops is now used for public purposes, and there is an old tower, a relic of the fortifications which were pulled down in 1884. Pilgrims visited Embrun in the Middle Ages to venerate a picture of the Madonna painted on the cathedral door. A large Roman station, the place became a bishopric soon after 300. The bishops (later archbishops) were princes of the Empire and rulers of an extensive territory. The see was transferred to Gap in 1791.

Embryo (Gr. *en*, in; *bryein*, to swell, teem with). In a general sense, an undeveloped idea or conception, the initial stage of anything. In biology it is the living creature which develops in the egg or womb; in botany, that part of the seed from which the plant is formed.

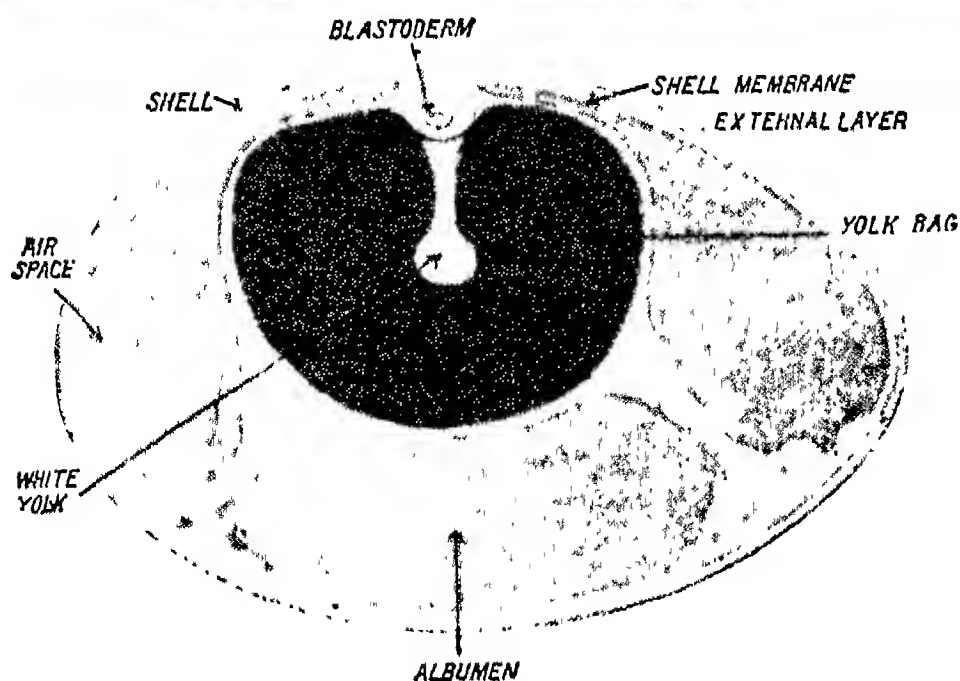
EMBRYOLOGY: STUDY OF THE EMBRYO

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This article explains the scope of Embryology, which studies the development of the individual in its early stages, before it has become recognizable for what it will be, except to the expert. See also Biology; Eugenics; Evolution; Life, etc., and biographies of Darwin, Lamarck, Mendel, etc.

Embryology (Gr. *embryon*, embryo; *logos*, science) is the science of the development of the individual in its early stages. This process starts in a single cell and is accomplished by the multiplication of that cell together with the growth and differentiation of the products of division till ultimately the complex structure of the young organism is apparent. In typical instances the single initial cell is the result of the union of two gametes, which in all but the simplest organisms differ. One, the female gamete, is relatively large and non-motile, the other, the male gamete, is relatively small and usually motile. It is the fusion of these two cells, fertilisation, which normally sets in motion the processes of embryo building.

ANIMAL EMBRYOLOGY. *The egg cell or ovum.* In most animals, egg cells are formed by the multiplication of primordial germ cells within the ovary of the parent. Some of the products of this multiplication ultimately become eggs (*see* Gametogenesis); but it frequently happens that a developing egg absorbs its sister cells or that they form a protective covering (follicle cells) for it. Thus, in the ovary of the fresh water polyp, hydra, and the marine tubularia, one egg only of the original many survives. A ripe egg is almost without exception spherical, or nearly so, and contains one haploid (*q.v.*) nucleus. It is large relative to most body cells owing to the accumulation within it as it develops of food reserve or yolk. The quantity of



Embryology. Hen's egg shown in section

this varies as does the size of the egg, which is about 1.6 mm. in diameter in the case of the frog, 1.7 mm. in man, and 0.06 mm. in the mouse.

Around the egg are eventually formed envelopes of various kinds which are derived from the egg itself, the follicle cells, or from secretions of the oviduct. What is normally called a bird's egg consists of the egg cell enormously dilated with yolk, surrounded in turn with a follicular envelope, a large amount of albumen (or white of egg), a thin shell membrane, and a porous shell.

Spermatozoa. Primordial germ cells multiply in the male organs to form numerous haploid spermatids which change their shape to become spermatozoa. These are extremely minute and typically consist of a head, chiefly nuclear, and a tail, by which the cell propels itself through liquid, sometimes a simple lash but frequently having a fin of cytoplasm running down most of its length. Its total length varies considerably in different species, being 50-60 microns in man, 20-27 microns in the crocodile, and in siredon some 360-430 microns. Differences occur in detailed structure, and some sperms have no tail.

Fertilisation. Contact between the two gametes is normally effected by the movement of the male gamete, which pierces the egg with its head. Thereafter, movement of fluid in the egg cytoplasm seems, in some instances at least, to carry the sperm inwards till it is in a position to unite with the egg nucleus. When this has occurred fertilisation is complete, and it results in (a) a change in the surface of the egg which inhibits the entrance of further sperms, (b) a mingling of the heritable material of the two gametes with the consequent formation of a diploid

nucleus for dividing to form the body cells of the new animal, and (c) a stimulus to the egg to divide.

Embryo development. Segmentation. Soon after fertilisation has occurred the egg cell nucleus divides, and the rest of the cell follows suit. The process is repeated, the two cells resulting

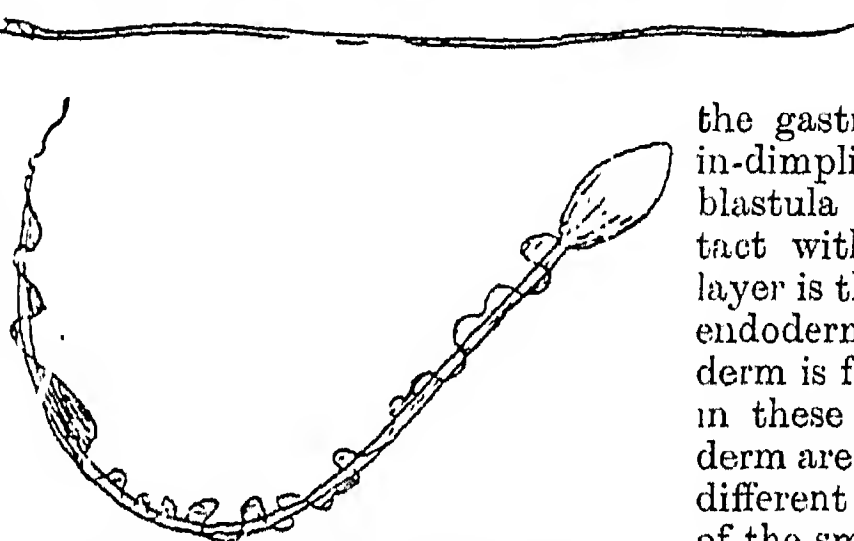
from the first division dividing to form four cells, the four to form eight, and so on. Eventually many cells or blastomeres are produced by this process of segmentation, which differs in detail according to the amount and distribution of yolk

the other. The result is to produce at first a ball of cells, which may be solid (morula stage), or may develop an internal cavity as it forms. Such a cavity or blastocoel is seen at the blastula stage in the frog embryo. Here it is floored by a hemispherical mass of larger yolky cells and roofed by a hemispherical dome of smaller cells. Alternatively, when yolk is abundant, as it is in birds, reptiles, and fishes, cell divisions may take place at first at one side of the egg only to produce there a plate of cells, or blastoderm, lying on the yolk.

Formation of germinal layers. In the developing embryo, be it of the blastula or blastoderm type, there are soon apparent groups of cells from which definite kinds of tissues and organs arise. These groups of cells are the germinal layers. In sponges and stinging animals, there are two fundamental cell groups

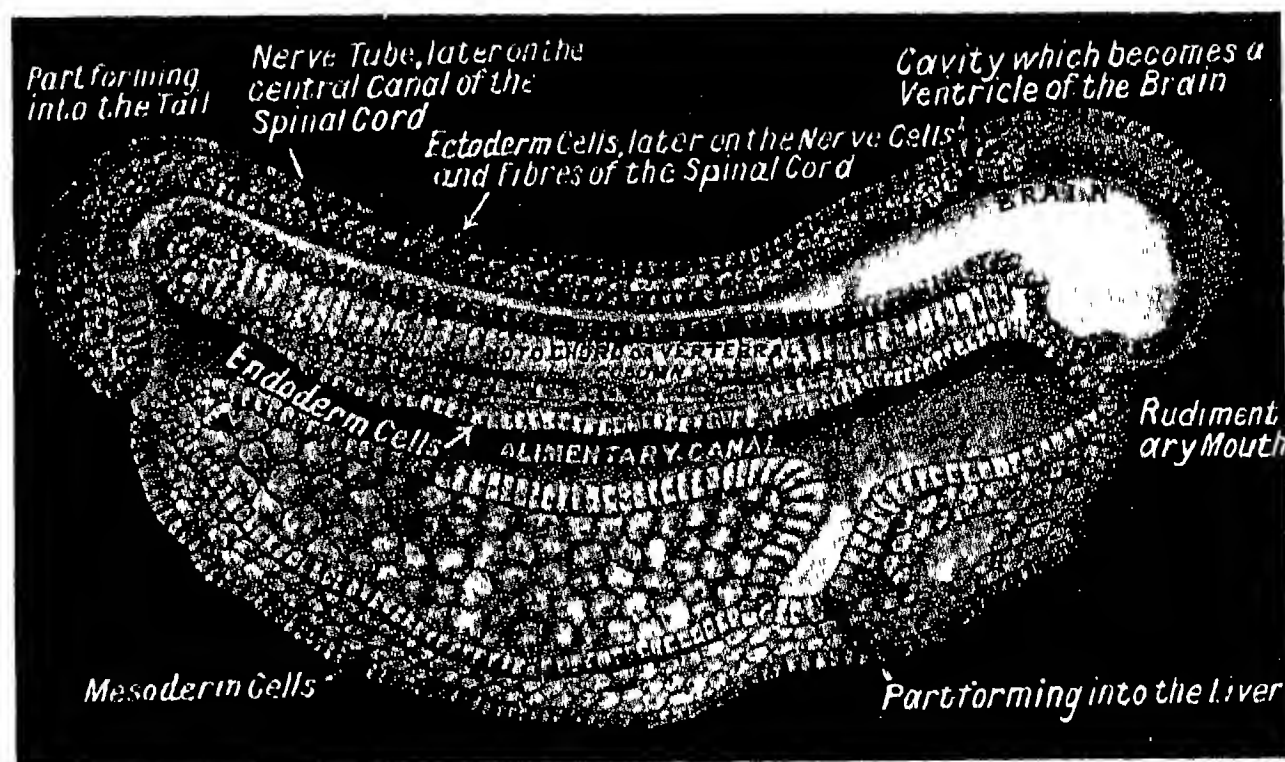
which become apparent as the two layers of the wall of

the gastrula, formed as if by the in-dimpling of one side of a blastula till that side makes contact with the other. The outer layer is the ectoderm, the inner the endoderm. A third layer or mesoderm is formed in vertebrates and in these the endoderm and ectoderm are established in a somewhat different manner. In the frog some of the smaller cells of the blastula, close to the yolk cells, tuck themselves in so that there is formed a lip overhanging the yolk cells. It is as if the skin of a soft toy balloon had been pinched to bring the inside of one part into contact with the inside of a neighbouring one. This process of intucking is progressive, but for simplicity it may be imagined that the two layered lip which is thus formed



Embryology. Spermatozoon of man.
Above, that of a horse

in the eggs. The whole egg, when it contains relatively little yolk uniformly distributed, may be involved and the cells formed all of a size, as in the sea urchin; or, when scanty yolk preponderates on one side of the egg, as it does in that of the frog, divisions may be unequal to give larger cells on the yolk side than on



Embryology. Sectional view of the embryo of a frog, illustrating how the brain, spinal cord, vertebrae, and alimentary canal are among the earliest parts of the developing animal to form

grows downwards and round the yolk and concurrently spreads sideways to become crescentic, semi-circular, and even more curved, till finally its corners meet and the lip forms a circular aperture. It is only within this aperture or blastopore that the main mass of the yolk cells is now exposed. Elsewhere it is completely covered by two layers of cells, ectoderm outside and endoderm inside, initiated by the lip. The process of envelopment has resulted in a new cavity. This is the archenteron and corresponds with the future alimentary canal. Between the endoderm and the ectoderm the mesoderm appears later.

In those embryos where segmentation leads to a plate of cells at one side of a large yolked egg, a lip develops in a somewhat similar fashion, either at the edge of the blastoderm or within it, and initiates germinal layers, an archenteron being less well developed in the higher forms.

Differentiation. When the germinal layers are established, the structure of the individual cells is simple; but thereafter changes in the form of cells and in their arrangement lead to the initiation of tissues and organs. Certain groups of cells and organs of the mature organism are regularly traceable to one or other of the germinal layers. Thus, the ectoderm regularly gives rise to the skin and the nervous system, the endoderm to the alimentary canal, lungs and liver, and the mesoderm to the skeleton, muscles, and vascular system.

Foetal membranes. As the embryo develops on one side of the egg from the blastoderm, this spreads, tending to enclose the yolk. In some instances, *e.g.* in fishes, enclosure occurs and there is thus formed a closed yolk sac attached to the ventral side of the embryo with its cavity continuous with that within the embryo itself. During the embryology of the more highly evolved vertebrates, membranes in addition to the yolk sac are derived from the extra-embryonal parts of the blastodisc. In birds, for example, the central region of the blastodisc only grows into the embryo. The marginal parts enfold the embryo in a two-walled, fluid-filled sac which serves as a water bath and cushion for it. The wall of the sac next the embryo is the amnion, and its intumed neck is joined to the edge of an aperture or umbilicus in the ventral side of the embryo. The outer wall of the sac is the false amnion or

chorion. Its neck may be considered as united with the edge of an uncompleted yolk sac, and by means of this joined through the umbilicus into the ventral side of the embryo also. Between the insertions of the amnion and the yolk sac, part of the developing hind gut of the embryo protrudes to form yet another sac, the allantois, which may enlarge until it completely fills the space between the amnion and the chorion.

Placenta. In placental mammals, the fertilised egg divides to form a morula. The surface layer of this separates, in the blastocyst stage, as the false amnion, from the inner mass or embryonic knob. Part of the false amnion becomes attached to the lining of the female parental uterus as a trophoblast (nutritional sac) to initiate the placenta, and the embryonic knob develops into the embryo with its amnion, yolk sac, and allantois. Parts of these become intimately associated with the false amnion and the uterine wall in the developing placenta to which the embryo is attached by their connexions (umbilical cord) with its umbilicus, the allantois ultimately forming the principal placental union.

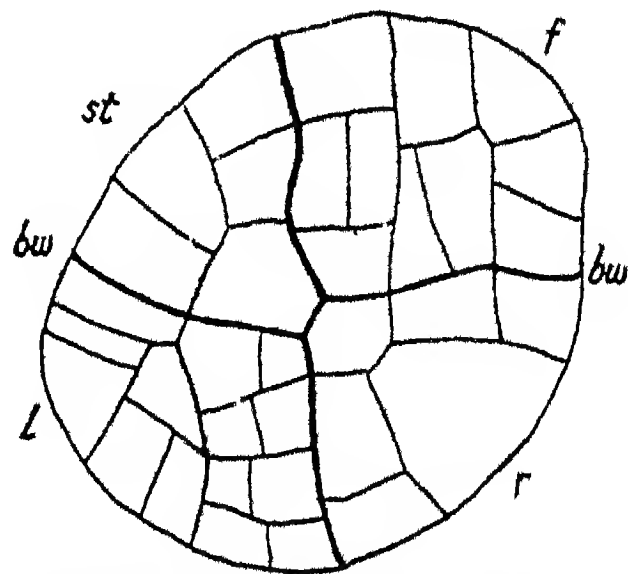
PLANT EMBRYOLOGY. *The Egg cell or Oosphere.* In relatively simple plants, oospheres are formed in oogonia, which are simple sacs, and the egg cell contains food reserve sufficient for its early post-fertilisation development. This process, however, usually results in a young independent plant without the intermediate formation of any recognizably peculiar embryonic stage. In the more complicated plants, egg cells are differentiated from among a number of other haploid (*q.v.*) cells constituting the gametophyte (*see* Alternation of Generation; Reproduction). During this differentiation, cells of similar origin may become specialised as archegonium wall cells, to contain the egg, or as canal cells of archegonium, or synergidae of embryosac, to facilitate the access of the male gamete. In such plants, material for embryo growth is supplied by the gametophyte, or, when this is scantily developed as it is in flowering plants, from the parent sporophyte direct.

Male gametes. These, like oospheres, are specialised gametophytic cells. Like the sperms of animals, they consist mainly of nuclear material. In most plants which form archegonia, the male gametes are antherozoids, formed in antheridia, and are motile by

means of cilia or flagella. Such motor organs are lacking in all but a few gymnosperms and in all angiosperms. The male cells of these plants are formed as the pollen germinates and are carried along in the cytoplasm of the pollen tube as it grows.

Fertilisation. Many antherozoids are known to exhibit chemotaxis (*q.v.*) and reach the oospheres by swimming through water to the neck of the archegonium, burst open in most instances by the conversion of the canal cells into mucilage through which entrance to the egg cell can be accomplished. Male cells of most gymnosperms and all angiosperms are conveyed to the eggs by the growth of pollen tubes which are guided by chemotropism into the necks of archegonia or between synergids. In all typical instances, fusion of the nuclei of male and female gametes initiates embryo development but, in angiosperms, a second nuclear fusion occurs, between a second male nucleus from the pollen tube and two polar nuclei, present in the embryosac cytoplasm, to produce the primary endosperm nucleus. From this there is later formed a triploid tissue, endosperm, peculiar to angiosperms, which may persist as a food reserve for the use of the embryo when the seed germinates.

Embryo development. In pteridophytes (fern-like plants) the oospore (fertilised egg) is contained in the venter of an archegonium projecting from the surface of the gametophyte plant. In some the oospore divides by a "basal" wall to form the first two cells of the embryo. Each of these cells

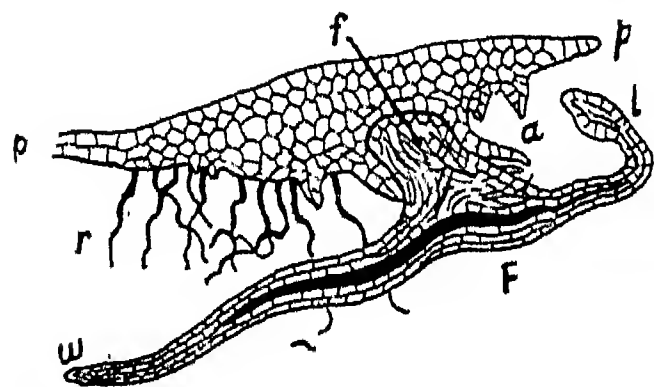


Embryology. Drawing of an embryo of *Adiantum* as seen from one side: bw, basal wall; st, stem apex; l, leaf apex; f, foot; r, root

divides again twice by walls at right angles to the basal wall and to one another so that there is produced a ball of eight cells--octants. Each of the octants divides repeatedly and during these divisions a

stem apex is initiated close to the intersection of the third and fourth walls with the surface of the embryo. This stem apex may be initially directed, according to the orientation of the basal wall, away from the prothallus (*e.g.* *Equisetum*) or obliquely sideways (*e.g.* leptosporangiate ferns) or towards the prothallus (*e.g.* *Marattiaceae*).

Suspensor and foot. In other pteridophytes (*e.g.* *Lycopods*), the first wall dividing the oospore, laid down usually at right angles to the axis of the archegonium, separates an outer "suspensor" cell from an inner embryo cell. The former by its enlargement serves solely to thrust the embryo cell into the nourishing prothallus: the latter undergoes further divisions to form octants, and later a stem apex, as in the instances already described. Whether or not a suspensor is formed, the young embryo develops in intimate association with the prothallial cells, and as it does so, part of it may become a mass of cells, called a foot, especially adapted to absorb nourishment from them. Near the stem apex a rudimentary leaf or cotyledon is formed which later grows upwards to expand its lamina in the light for photosynthesis, and between the cotyledon and any foot which may arise a root apex is established



Embryology. *Adiantum capillus veneris*, longitudinal section through prothallus, p, p, and young fern, F; r, rhizoids; a, archegonia of prothallus; f, foot; l, first leaf; w, first root of embryo

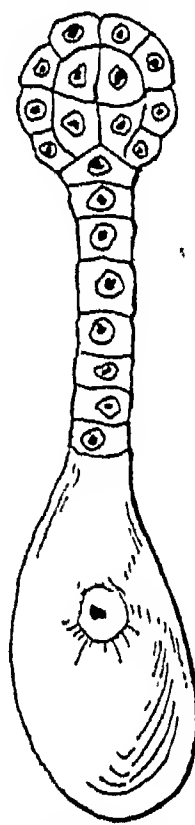
which grows into the soil as the first root. As soon as the cotyledon and the root are functioning adequately, the young plant is independent of the prothallus, which shrivels.

Proembryo. In seed plants the oospore divides to form a proembryo, only part of which is concerned in the production of the embryo proper. In the cycads the proembryo is an extensive tissue formed by free cell formation from the whole egg, but in the conifers it consists of relatively few cells, in the pines being derived from one end of the egg only. In most gymnosperms a middle portion of the proembryo elongates considerably as a suspensor to carry the

apical embryo cells deep into the female prothallus which constitutes the main bulk of the developing seed. Multiplication of embryo cells subsequently results in the embryo proper with its radicle directed towards the suspensor and its plumule or leading bud pointing in the opposite direction and surrounded by two or more cotyledons. Such embryos embedded in female prothallus and surrounded by seed coats remain dormant until the seed is dispersed and until, conditions being suitable, they continue their development into seedlings during germination.

Endosperm. In angiosperms the egg cell occupies a position at the micropylar end of the embryosac of the ovule. This sac also contains its own cytoplasm in which are two polar nuclei. Fertilisation is a two-fold process. Two male nuclei emanating from the pollen grain are concerned. One fuses with the oosphere nucleus and the other with the two polar nuclei. From the fertilised egg there is formed a proembryo, a thread of cells which comes to project into the middle of the embryosac. The innermost cell of this row is chiefly responsible for the formation of the embryo, which thus begins its development in the cavity of the embryosac. The remainder of the proembryo is the suspensor, and shrivels as the embryo completes its development.

While these changes are taking place in the oospore, the primary endosperm nucleus divides to produce many nuclei that are centres for the organization of endosperm cells within the embryosac wall. These cells tend to increase in number so as to encroach on the embryosac cavity within, and the nucellus of the ovule without, the measure of the inward encroachment accomplished depending to a degree on the relative speeds with which the embryo and the endosperm grow. Should the embryo develop relatively slowly prior to seed dispersal, it may, at that time, be a mass of meristem cells either in the form of an undifferentiated plug or showing differentiation of radicle, one or two cotyledons, and perhaps a plumule, embedded in endosperm tissue whose substance



Young embryo of shepherd's purse at end of suspensor

is absorbed during germination. Alternatively, with relatively more rapid development some part of the embryo such as the cotyledons or the hypocotyledon stem may absorb the endosperm-forming substance as it comes into the embryosac from without, the embryo cells maturing accordingly, and the seed coming to contain no endosperm when it is ripe.

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Emden. Town and seaport of N.W. Germany, in the Hanoverian part of the new Niedersachsen state. It stands at the N. of the Dortmund-Ems Canal which links the Ruhr with the sea. This port was the fourth largest in Germany, with an average peace-time turnover of more than 20,000 vessels. Ruhr coal, Swedish iron ore, grain, timber, and fish were the main goods passing through. Fish curing and trade based on the surrounding agriculture and cattle breeding were other concerns. Under the Nazi regime Emden was developed for war purposes, and a submarine base and yards were created, which attracted heavy air attacks during the Second Great War.

The town itself, the central parts of which preserved with their canals and gabled houses a Dutch character, was founded in the 10th century, was given urban rights in the 14th, and became wealthy. In 1402 it fell to Hamburg. It was a free city of the Empire under Dutch protection in 1595, having benefited from the transfer of English warehouses from Antwerp to Emden. Part of Prussia from 1744, it was made a free port by Frederick the Great. After suffering from blockade during the Napoleonic wars, it belonged to Hanover 1815-66, and then reverted to Prussia. A fine town hall in Flemish style (1576), and the Great Church (12th century), were both wrecked in the Second Great War. The town was occupied by the 3rd Canadian div. on May 7, 1945. Pop. 34,111.

Emden. Name of a series of German light cruisers. The first, of 3,600 tons, launched in 1908, became famous at the outbreak of the First Great War for the damage she did to British and Allied commerce and for the humanity shown by her commander, von Müller, to the crews of the ships he sank. The Australian cruiser Sydney, learning that the Emden was at Cocos Island, drove her ashore on North Keeling Island and destroyed her with a loss of 230 on Nov. 9, 1914. Müller was saved and allowed to retain his sword. This was the first action by a ship of the Australian navy.

Another Emden was built in 1915, was surrendered to the Allies after the armistice, and in 1920 was allotted to France. A third, completed at Wilhelmshaven in 1925, was one of the earliest units of the new German navy. She displaced 5,400 tons on a length of 508 ft., had eight 5.9-in. guns, and could sail at 29 knots. She was used as a cadet training ship, but going into action in the Second Great War was rendered useless by a Norwegian minelayer on April 10, 1940.

Emerald (Gr. *smaragdos*, Fr. *émeraude*, Span. *esmeralda*). Green variety of mineral beryl, a metasilicate of beryllium and aluminium with traces of chromic oxide, found in granitic or schistose rocks, and in veins traversing them, also in bituminous limestone (Colombia). It crystallises in hexagonal system, and forms long six-sided prisms; it is valued as a gem-stone when clear and well coloured. Perfect crystals are rare; many stones show "mossiness" due to tiny fissures and air bubbles, while the colour is often irregularly distributed. Emeralds of antiquity came from Egypt; its mines, reopened in the 19th century, yield handsome stones, though generally small and rather pale. The finest crystals come from S. America, chiefly Colombia, and from the Urals; a few are found in Austria, Australia, and the U.S.A.

Certain other stones are known as emeralds. The rare "oriental" emeralds are green corundum; "Brazilian" are green tourmaline; "Uralian" are green garnet; "evening emeralds" are bottle-green olivine; "false" are fluorite; while "mother of emerald" is green quartz, and "emerald copper" is diopside (a green silicate of copper).

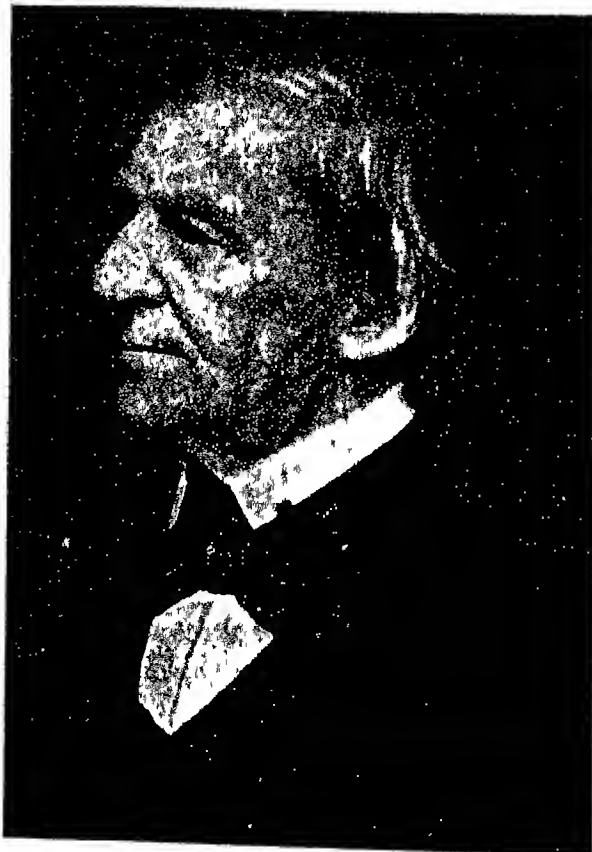
Artificial emeralds are made by fusing together 4,608 parts of

strass, 42 parts of copper oxide, and 2 parts of chromic oxide. A finer quality, known as "synthetic" or "scientific" emeralds contains 7-8 p.c. of beryllia, but although almost identical, these are of lower specific gravity and refractivity than the true stones, and are almost always "cloudy" or "mossy." "Emeraldines" are artificially coloured chalcedony.

Emerald Green. Name applied to certain green colouring matters. The two mineral emerald greens are aceto-arsenite of copper and hydrated chromium sesquioxide. The aniline dye emerald green is prepared by the action of benzaldehyde upon diethylaniline and subsequent oxidation.

Emergency Powers Acts. British Acts of parliament providing for special administration in time of emergency. An Act of 1920 gave the king power to declare a state of emergency, and the govt. power to deal with it, should action be taken or threatened calculated to deprive the community of the essentials of life. Such a state of emergency was declared in 1926 (see General Strike), and in 1949 during an unofficial strike of London dockers. Under the Emergency Powers Act, Aug. 24, 1939, Defence Regulations (*q.v.*) were issued during the Second Great War.

Emerson, RALPH WALDO (1803-82). American poet, essayist, and philosopher. He was born at Boston, Mass., May 25, 1803, the son of a Unitarian minister, and was educated at the Boston Latin school and Harvard. After graduating in 1821, he spent three years in teaching, and then, having entered the Unitarian



R. W. Emerson

ministry, was appointed joint minister of the Second Church in Boston, 1829. He married Ellen Louisa Tucker, who died in 1832, and in that year resigned his ministry in consequence of his widened views, to which he had given expression in a sermon on the Lord's Supper (Works, vol. xi, 7), which did not meet with the approval of his congregation.

In 1833 Emerson travelled in Europe, visited Carlyle, and began that lifelong friendship with him which bore literary fruit in a notable collection of letters. On returning to America he settled at Concord, Mass., and entered upon his career as writer and lecturer, which, in a few years, was to place him in the front rank of American men of letters. The year after settling in Concord, he married Lydia Jackson (1802-92). In 1836 he published a slim volume, *Nature*, in which he briefly stated the case for a new outlook on things in place of the continued acceptance of mere tradition. In subsequent addresses, lectures, and essays, the thoughts enunciated in *Nature* were enlarged upon and developed. In 1840 he commenced writing for *The Dial*, and edited it for two years; this magazine came to be regarded as the special organ of the New England Transcendental movement in religion, literature, and philosophy.

The first volume of those essays by which he was to become most widely famous was published in 1841; a second followed three years later. In 1847 the first collection of his poems was published, and in the autumn he revisited England on a lecturing tour, delivering a series of addresses on Representative Men—Plato, Swedenborg, Montaigne, Shakespeare, Napoleon, and Goethe. The volume containing these addresses was published in 1850. In 1856 the fruits of his observation during his extended stay in England were embodied in *English Traits*.

Writing and lecturing, he came to take a high position as the chief leader of American thought of his generation, and, despite some unfavourable comment on his somewhat staccato literary style, to be recognized in England as a great, suggestive, and stimulating writer. In 1872, his house at Concord was partly destroyed by fire, a disaster which caused him a severe shock; it was, however, rebuilt by his friends and admirers, and he sought health by revisiting Europe. He died at Concord,

where his house still stands, on April 27, 1882, and is buried in its famous cemetery of Sleepy Hollow.

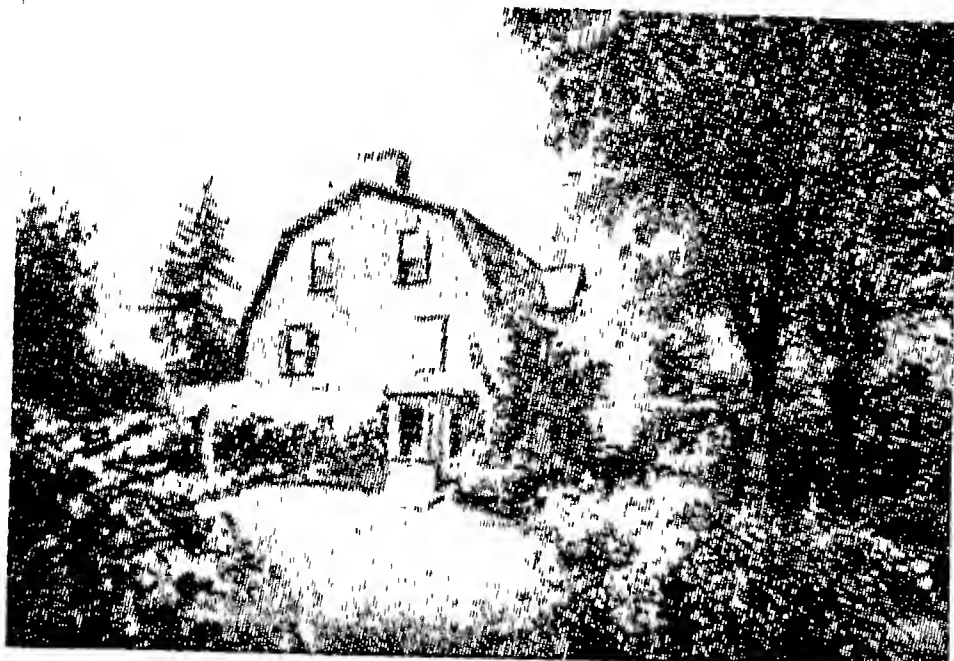
The work which Emerson left, alike in prose and in poetry, is peculiarly individual. He was, perhaps, essentially a poet, but only in a small degree a singer; his verse, often marked with penetrating thought

and lofty conception, is, for the most part, lacking in beauty of form or music. His philosophy is that of the moment's consideration rather than of any fully developed scheme; is, indeed, the philosophy of the poet rather than of the scientist. Less as master of any definite course of philosophy than as a stimulator of thought along idealistic and optimistic lines did he exercise great influence on his time. His position in this respect is perhaps best summed up in the words of Richard Garnett: "More than any of the other great writers of the age he is a Voice. He is almost impersonal. He is pure from the taint of sect, clique, or party. He does not argue, but announces; he speaks when the spirit moves him, but not longer. Better than any contemporary, he exhibits the enigma how Confucius and Buddha and Socrates and greater teachers still should have produced such marvellous effects by mere oral utterance." The effect of his work, it has been said, is that of good and stimulating conversation; but it is conversation on a high and impersonal plane. His utterance has something of a finely-balanced sanity, and though at times it may suggest the mystic, it is the mysticism of a glorified common sense, not that of mere nebulosity.

Walter Jerrold

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Emery (Sp. *esmeril*). Mineral composed of corundum (aluminium oxide) with much iron present, mainly as admixed iron minerals, e.g. magnetite. It is therefore not properly a true mineralogical variety. It occurs



Emerson. The old manse at Concord, Massachusetts, where Emerson settled in 1833, and where Nathaniel Hawthorne lived during 1842-46

as black granular masses found in crystalline limestones or aluminous sediments as the result of metamorphism, or in residual deposits concentrated during the weathering of such rocks. The chief deposits occur in Naxos, Greek Archipelago; Aidin, Asiatic Turkey; and the Central Urals, U.S.S.R.

The toughness and hardness of emery make it a good abrasive and it is used in the manufacture of paper, cloth, and wheels. Emery wheels were once much used for grinding, but have largely given place to such artificial compounds as carborundum (*q.v.*) or aluminium oxide, bonded and made into grinding stones and wheels. Emery paper and emery cloth, coated with emery powder, are used for cleaning and finishing metalwork; emery powder as an abrasive in domestic and industrial work. In all these fields the newer abrasives mentioned are taking the place of natural emery. See Grinding.

Emery, WINIFRED. Stage name of Isobel Winifred Maud Emery Maude (1862-1924), British actress. Born at Manchester, Aug. 1, 1862, in 1888 she married Cyril Maude (*q.v.*). Her first appearance on the stage was at The Amphitheatre, Liverpool, 1870, as Geraldine in *The Green Bushes*; her first London appearance was in pantomime at The Princess's, 1874. A versatile actress, she appeared with Wilson Barrett, Comyns Carr, Forbes Robertson, and Beerbohm Tree. She accompanied Henry Irving to the U.S.A. in 1884 and 1887-88. She died July 15, 1924.

Emetic (Gr. *emetikos*). Substance administered medically to cause vomiting. Emetics are occasionally used in cases of simple illness. Dyspepsia and sick headache caused by excessive eating

may sometimes be relieved by emptying the stomach of its contents. Another use is in conditions of difficulty of breathing caused by bronchitis, especially in children, the act of vomiting stimulating the respiratory mechanism and relieving the distress.

The chief use of emetics is to remove poison from the stomach. This form of treatment may be adopted with safety in almost all cases where poison has been swallowed, except poisoning from strong mineral acids which corrode the stomach wall and render violent movement of the organ undesirable. Some knowledge of emetics should be possessed by every household, for the prompt administration of an emetic may avert serious symptoms, and even save life which would be lost if treatment were delayed. The simplest emetics are a tablespoonful of mustard, or one or two tablespoonfuls of salt, in a tumbler of warm water. The following emetics should be taken only under medical advice.

Zinc sulphate: 10 to 30 grs. dissolved in half a tumbler of warm water, repeated if necessary. Ammonium carbonate: 15 to 30 grs. dissolved in warm water. Ipecacuanha: four to six drams of the wine, or 20 to 30 grs. of the powdered root.

Apomorphine is best administered hypodermically in doses of $\frac{1}{10}$ gr. This emetic stimulates the nerve centre in the brain which controls the process of vomiting; it is particularly useful in poisoning by narcotics such as opium.

Emetine. Chief alkaloid found in the roots of ipecacuanha (*Cephaelis Ipecacuanha*). It is extracted from finely-powdered root by means of alcohol or other solvent to remove the total alkaloids. It is a violent emetic, but in medicine is considered a specific remedy for amoebic dysentery.

Emett, ROWLAND (b. 1906). British artist, remembered for his cartoons featuring wispy little men and fantastic trains and other machines made of scrap. Born in London, Oct. 22, 1906, he was a serious landscape painter until 1939, when he first contributed a cartoon to *Punch*. During 1944-48 he was deputy art editor of *Punch*. He created the Far Tottering and Oyster Creek railway which ran in the Battersea gardens during the Festival of Britain, 1951. He also designed wallpaper, fabrics, china.

Emigration. Systematic migration of the surplus population of one land to another for per-

manent settlement. This movement has been one of the great factors in shaping the world, more potent even than military conquest. The ancient world witnessed vast migrations of people in quest of food and living space and under the pressure of climatic changes: such was the Teutonic surge westwards over Europe to the Atlantic border. The dispersal of the Jews, especially after the destruction of Jerusalem, was a migratory movement of a different kind.

After the discovery of America, emigration developed contemporaneously with the era of the merchant adventurers. Spain led the way, absorbing enormous areas in S. America and in the southern half of N. America. Portugal and Holland played a part, but Spain's main rivals were France and Great Britain. The enterprise of the merchants of Bristol gained a foothold in Newfoundland from which the British people spread to the Pacific in the W. and Mexico in the S. Everywhere, but especially in N. America, French and British found themselves rivals in the race for new lands.

Religion played a large part in the first emigration movements. Zeal for the Catholic Church led Spain to attempt to establish on a large scale model Catholic nations in S. America. The effort to create new peoples to overcome the growing heresies of Europe influenced the French kings in their pious endeavours to build up New France along the banks of the St. Lawrence. The departure of the Pilgrim Fathers from Plymouth in 1620 for New England laid the foundations of the U.S.A. A second great impelling force was poverty; and a third political discontent. The most marked example of these was the steady exodus of the Irish people to America during the famines and troubles of the 19th century. A fourth cause is love of adventure and ambition, of which the most striking instance is to be found in emigration from Britain.

As Spain and Portugal declined, the outflow of their peoples ceased. The Dutch settlers in N. America were gradually absorbed by their English-speaking rivals. S. Africa remains the outstanding example of successful Dutch settlement. The people of France, defeated in their struggle for supremacy in N. America after the Seven Years' War, became one of the least migratory nations in Europe, but the province of Quebec still re-

mains distinctively French under the British flag. Britain maintained the outpouring of her people. While she lost political control of a large part of N. America, the U.S.A. retained the English language, and the British stock predominated. The convict settlements of New South Wales and Tasmania gave way to the free British commonwealth of Australia. The growth of Australia and the opening up of the Pacific coast of N. America were enormously stimulated by the discovery of gold in California and Victoria in the middle of the 19th century.

The defeat of the liberal movement and the triumph of imperialism in Germany stimulated a German migration westwards, which militarism and poverty did much to encourage. The German emigrants before the First Great War went mostly to the U.S.A. and to S. America. After the war their migration to the U.S.A. was checked, and they tended to go in larger numbers to S. America, Poland, and W. Russia.

Abundant industrial openings and high wages in the U.S.A. made it the Mecca of the European emigrant. The flow of population across the Atlantic early in the 20th century averaged 1,000,000 a year; three-quarters came from Russia, Italy, and Austria-Hungary. By 1938 the net inflow was down to 30,000. Despite the immigration from Continental Europe, the most considerable section of the foreign white stock in the U.S.A. is from the British Isles. Canada failed to draw any considerable number of new settlers until near the close of the 19th century. Then, partly on account of the closer settlement and growing scarcity of land in the U.S.A., a big movement, largely of farmers, started from there into the prairie provinces.

One of the most significant movements of emigrants during 1920-40 was the large Japanese emigration all over the Pacific coast and islands due to the rapid growth of Japanese populations. This gave rise to serious difficulties with the white nations of the Pacific, more particularly with the people of California, who caused deep offence in Japan by passing exclusive legislation. A similar policy was adopted by Australia. A great part of the movement of emigration in earlier years was uncontrolled by governments, but economic and political stresses have increasingly led governments to regulate the settlement of aliens.

Most countries have adopted immigration quotas, limiting the inflow to settlers of certain types or occupations. To assist British subjects of suitable categories to emigrate to the dominions, an Overseas Settlement department was set up in 1922, and schemes of assisted emigration were drawn up by the dominions themselves.

The period, which included the preparations for the Second Great War, the war itself, and its aftermath, was marked in Central Europe by forced migrations on a large scale. A solution of acute minority problems (e.g. that of Sudeten Germans in Czecho-Slovakia) was sought by dispossessing those of the minority stock and transporting them to their countries of historical origin. See Alien; Coolie; Immigration; Population.

Émigrés. Term applied to Frenchmen who sought refuge in foreign countries during, and immediately after, the French Revolution. Most of these supporters of the old regime went to the Rhenish states of Germany, but everywhere actively advocated the restoration of the Bourbon dynasty. Their hopes of a speedy accomplishment of this object were shattered when the French Revolutionary armies defeated the Prussians and their allies at Valmy in 1792. After the final overthrow of Napoleon in 1815 the *émigrés* who were still alive or had not permanently settled abroad returned to France.

Emilia-Romagna. Region of N. Italy. It slopes from the Apennines to the river Po and the Adriatic. The name Emilia is derived from the Roman Via Aemilia, the great N. road which passed through the territory. The region includes the provinces of Bologna, Ferrara, Forlì, Modena, Parma, Piacenza, Ravenna, and Reggio Emilia. Low-lying along the coast, it is elsewhere hilly, and is drained by tributaries of the Po. Area 3,540 sq. m. Pop. (1951) 3,510,683.

Eminescu, MIHAIL (1849-89). Rumanian poet and editor. Born at Ipateshti in Moldavia, Dec. 26, 1849, he was educated at the universities of Vienna, Jena, and Berlin. In 1870 he contributed two memorable poems, *Venere si Madona*, and *Epigonii*, to the *Convorbiri Literare*, and in 1874 he was appointed school inspector and librarian in the university of Jassy. He died at Bukarest, June 15, 1889. He is regarded as a great lyric and satiric poet.

Emin Pasha (1840-92). German administrator. Born at Oppeln, Silesia, March 28, 1840, of

Jewish parents, his real name was Eduard Schnitzer. After studying medicine at Breslau and Berlin, he took up an appointment on the staff of Hakki Pasha, in Turkey. In Egypt, in 1878 he was appointed by Gordon governor-general of the equatorial province. When the Sudan was abandoned Emin was left in the heart of the country, whence he was rescued by Stanley in 1888. Returning, in the German service, he met his death at the hands of Manyama Arabs, Oct. 23, 1892. His success in abolishing the slave trade in the district under his control, his careful survey of over 4,000 miles of road, and his observations of the flora, fauna, and meteorology of the country gained him an enduring reputation.

Emir. Arabic word meaning commander, also spelt ameer (*q.v.*) or amir. It is used for chiefs and other rulers of certain Mahomedan peoples, the form emir being mainly confined to those in Africa.

Emissivity. The ratio of the heat energy emitted by a unit area of the surface of a body under given conditions to that emitted by the same area of a perfect black body under the same conditions. This is always exactly equal to the absorptive power. A surface coated with lamp-black will absorb practically all the heat energy falling upon it without reflection; its absorptive power is taken as unity. A surface heated uniformly and viewed through a small hole approximates to black body conditions, but if an article be taken out from the furnace into the open its surface will reflect and so it will radiate less energy than a black body at the same temperature. Emissivity thus depends on the kind of surface, the temperature, and the wave-length radiated. Optical and radiation pyrometers, used for measuring liquid steel and metal temperatures, are often calibrated for ideal black body conditions, so it is useful to know the emissivity of metals under various conditions.

Emma (1858-1934). Queen of the Netherlands. Daughter of the prince of Waldeck-Pyrmont, she was born Aug. 2, 1858, and in 1879 married William III, king of the Netherlands. Her daughter Wilhelmina (*q.v.*) became heiress to the throne on the death of William's sons by his first consort, and when William died in 1890, Emma was regent for eight years. Her many charitable acts endeared her to the poorer classes. She died March 20, 1934.

Emma. Novel by Jane Austen, written in 1815 and published the following year. It is one of the best of its author's works, full of character and humour in the presentation of the society of Highbury, a "large and populous village almost amounting to a town."

Emmanuel College. College in the university of Cambridge. It was founded in 1584 by Sir Walter



Emmanuel College arms

Mildmay, chancellor of the exchequer, and is governed under a statute dated 1957. Of the original buildings of the Dominican house adapted to the use of the college at its foundation, the dining hall, fellows' combination room, old library, and parts of the master's lodge and the kitchen survive. Old Court dates from 1633; the chapel (bearing the date 1677) and gallery are the work of Wren; the rest of the buildings of Front Court which front St. Andrew's Street date from the 18th century. New Court dates from the early 19th century and North Court from 1914. The college was long a stronghold of Puritanism; among its famous men were Archbishop Sancroft and John Harvard, founder of the American college (later university) named after him. See Architecture illus. p. 552.

Emmaus. Town of ancient Palestine. It is now represented by the village of Amwas, on the road between Jaffa and Jerusalem, noted for a medicinal spring. It is not to be confused with the Emmaus of the N.T., near which Christ appeared to His disciples after the Resurrection; the site of this is unknown.

Emmen. Town of the Netherlands, in Drenthe. It is 29 m. S.S.E. of Groningen, just N.W. of the Berger Meer, and on the road from Groningen to Koevorden. It is the centre of a district engaged in agriculture and stock rearing. Pop. (1955) 62,032.

Emmenthal Cheese. Swiss cheese, similar in appearance to Gruyère (*q.v.*), but half as large again, and with higher milk content. Though Swiss by origin, it is also made in mountainous districts of S.E. France and elsewhere.

Emmerich. Town of Germany in North Rhine-Westphalia. It stands on the right bank of the Rhine, 5 m. N.E. of Cleves, and not far from the frontiers of the Netherlands. The minster church was built in the 11th and 12th

centuries. Emmerich is an old place, having been a Roman settlement. In 1217 it was made a town; in 1407 it joined the Hanseatic League, and as part of the duchy of Cleves it passed into the possession of Brandenburg in 1609. Having been for a few years part of Berg, it was returned to Prussia in 1815. Heavily bombed and shelled by the Allies during the Second Great War, Emmerich was captured by the 1st Canadian army on March 29, 1945. It had been stubbornly defended by German parachute divisions and was completely destroyed.

Emmet, ROBERT (1778-1803). Irish nationalist. Youngest son of the physician to the viceroy, and



Robert Emmet, Irish nationalist After Petrie

brother of the United Irishman, Thomas Addis Emmet (1764-1827), he was born in Dublin and educated at Trinity College there. During 1800-02 he travelled on the Continent, and was fired with the idea of securing French aid from Bonaparte in a rising against England. He collected arms at depots in Dublin and drew up a full plan of campaign for a rising on July 23, 1803. But treachery and faulty organization frustrated his plans, and Emmet fled into the Wicklow Mts. On Aug. 25 he was arrested near Harold's Cross, was found guilty of treason, and hanged, Sept. 20. The hold of Emmet's memory on popular imagination in Ireland was increased by the story of his love affair with the daughter of John Philpot Curran (*q.v.*), which inspired Moore's lyric, *She is far from the land where her young hero sleeps*. A study by R. Postgate appeared in 1932.

Emney, FRED (1865-1917). A British comedian. Born in London, March 5, 1865, he appeared at Sadler's Wells in *The Ticket of Leave Man* in 1885. One of the most popular comedians of pantomime, he produced in 1912 the sketch by which he is best remembered, *A Sister to Assist 'Er*—opening with the often-quoted line, "Is Mrs. May hin?"—and, with Sydney Fairbrother, acted in it for three years. While rehearsing for a pantomime he slipped and received a fatal injury, from which he died, Jan. 7, 1917. His son Fred (b. 1900) also became a well-known comedian, distinguished for his great girth.

Emotion (Lat. *emovere*, to agitate). State of mind of an affective type. Emotions are chiefly composed of specific feeling-tones which differ greatly, *e.g.* triumph, rage, despair. They are pleasant or unpleasant, sometimes to a high degree. The strength, duration, and pleasantness or painfulness of emotions vary greatly from man to man; some enjoy violent anger, while others are exhausted by it or experience anxiety.

The original sources of emotions are situations which evoke instinctive action. Fear is caused by danger; sympathy by the sight of pain or grief. Emotions may subsequently be reawakened at a time when they bear little relation to the real needs of the individual; *e.g.*, some feel "fighting-mad" when questioned by a policeman. Once roused, emotion is not easily modified by either reason or conscience, and when violent tends to control behaviour and affect beliefs. In many people emotion is easily switched from one object to another: thus arises the state known as "spoiling for a fight." For all these reasons emotion has been generally reviled by moralists. Emotions are unreliable guides to conduct and opinion, and one of the chief objects of moral education is to bring them under control. Yet they add colour to life; and the group known as "disinterested," including pity, and love of offspring, is indispensable to society.

Emotions have a marked effect upon many bodily functions. They cause the muscles of the face to assume expressions, through which we recognize the feelings of others. Attitudes, breathing, the action of the heart, the autonomous nervous system, and the ductless glands may all be changed. Consult *Expression of the Emotions in Men and Animals*, C. Darwin, 1872; *Psychology of the Emotions*, T. A. Ribot, 1897.

Empedocles (c. 495–435 B.C.). Greek philosopher of Agrigento in Sicily. He was the first to teach that all material substances are compounded from the four so-called elements, fire, air, earth, and water. These four elements are continually being separated and mingled by two moving forces, one Love or Friendship, the other Strife. He thus combined the Being of the Eleatics (*q.v.*) with the Becoming of Heraclitus (*q.v.*). According to legend, Empedocles threw himself into the burning crater of Etna in order that the completeness of his disappearance

might engender the belief that he had been translated alive to heaven. This is the subject of Matthew Arnold's *Empedocles on Etna* (1852). *Pron.* Em-ped'-o-kleez.

Empedrado. Town of Argentina, in Corrientes prov. It is on the Paraná, some 650 m. by rly. N. of Buenos Aires, also reached by steamer via Corrientes. It is the centre of a fruit-growing region. Pop. 24,300.

Emperor (Lat. *imperare*, to command). Title applied to sovereigns of the highest class. It was first used in this sense by Julius Caesar, who, among other titles, called himself *imperator*, a title hitherto borne by certain officials while in command of troops abroad. His nephew Augustus established the empire, and the title was borne by his successors both in Rome and in Constantinople; it was taken by Charlemagne when in 800 he founded the medieval empire. The rulers of the Holy Roman Empire bore it until the dissolution of that body in 1806, and in the 19th century it was assumed by several rulers who regarded themselves as more powerful than ordinary kings. Chief among these was Napoleon, who in 1804 assumed the title of emperor of the French, an example followed in 1852 by Napoleon III.

While the English translated the word *imperator* as emperor and the French as *empereur*, the Germans had rendered it as *Kaiser*, a tribute to Caesar, and this was the title taken by Francis II when he became emperor of Austria in 1804. In 1871 William I took the title of *Deutscher Kaiser*, but in both these cases the idea was well represented by the English word emperor. Less correctly, perhaps, the Russian *tsar* was freely translated emperor.

In the New World there were emperors of Brazil from 1821 to 1889, and in 1864 Maximilian of Austria took the title when he set up his empire in Mexico. The word is also used to translate the titles of rulers of Eastern countries: for instance, we speak sometimes of the emperor of Japan. In 1877 Queen Victoria became empress of India—the first British sovereign to bear the title *Kaisar-i-Hind*. The Greek word *basileus* is usually translated emperor. This was applied to certain rulers before the Christian era, and was taken by the emperors at Constantinople.

The original idea was that there could be only one emperor, whose authority extended throughout Christendom, and who was the overlord of kings. The modern

tendency is to use it for the ruler of a collection of countries, but, although we speak of the British empire, it has, strictly speaking, no emperor. See *Sovereignty*.

Emperor Butterfly OR PURPLE EMPEROR (*Apatura iris*). Large British butterfly, localised in oak-woods of S. and S.E. England. Usually it frequents the tops of trees, but descends to feed on carrion. The male is dark brown with a rich purple sheen; a white band and spots occur on the wings. The female is without the purple reflection. The caterpillar feeds on the willow. See *Butterfly*; also colour plate facing p. 1598.

Emperor Concerto. Title bestowed upon Beethoven's concerto in E flat for pianoforte and orchestra (op. 73). Composed in 1809, and dedicated to the archduke Rudolph, this was the fifth of Beethoven's piano concertos, and is remarkable for spaciousness and several innovations, *e.g.* the linking of the second and third movements; instead of the traditional tutti for orchestra at the beginning of the work, the piano-entry at the second bar; and dispensing with the customary cadenza (hitherto improvised by the performer), Beethoven writing his own. The concerto may be considered one of his most popular compositions.

Emperor Moth (*Saturnia pavonia*). Large, fairly common British moth; the male flies in sunshine and the female is mostly a night-flier. The wings are mottled brown and tawny, with a conspicuous eye in the middle of each. The caterpillar feeds on the willow, bramble, heather, and other plants.

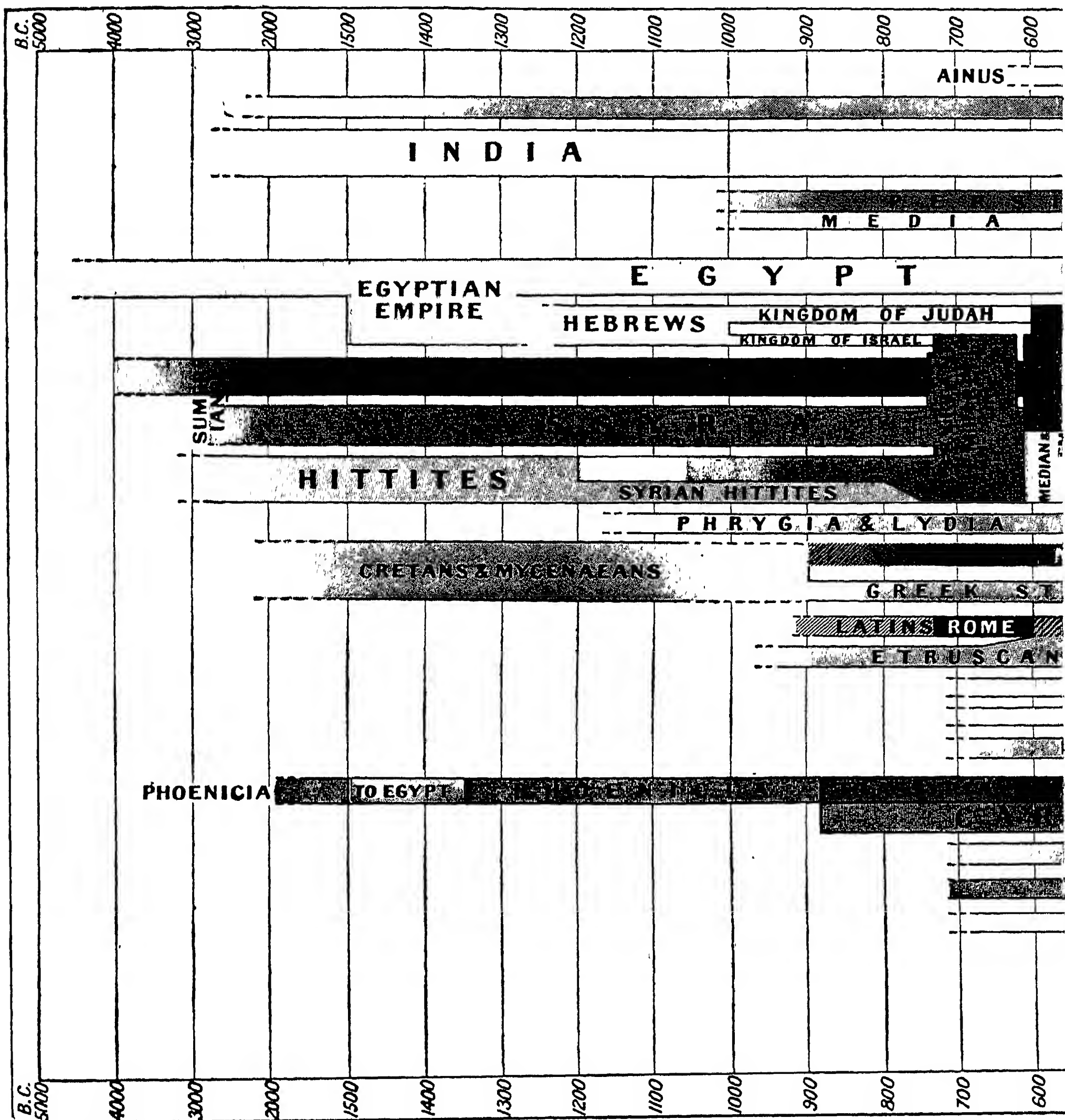
Empetraceae (Gr. *empetros*, growing on rocks). Family of evergreen heath-like shrubs. They are natives of the N. temperate and arctic zones, also of Chile and Tierra del Fuego. They have small.



Emperor Moth,
Saturnia pavonia



Empetraceae. Leaves and fruit, also shown in section, of red crowberry



At some undefinable date in the neighbourhood of 4000 B.C. there are indications that social life in Egypt and Mesopotamia was progressing towards the formation of organized states. History in both these regions opens shortly before 3000 B.C.; and it should here be noted that whereas this chart is divided into 100-year intervals back to 1500 B.C. (roughly the date of the first empire in a modern sense), the preceding intervals are compressed. Actually the period between 3000 and 1500 B.C. should occupy as much space as the subsequent period to the beginning of the Christian era.

During all these centuries there were approximations to imperial expansion. Thus in Mesopotamia Lugal-zaggisi, about 2770 B.C., established a hegemony, taken over and maintained for little more than a century by the kings of Agade; the "empires" of the kings of Ur (c. 2400) and of Hammurabi of Babylon (c. 2100) were equally transient. Sinai and Nubia were early brought under Egyptian rule.

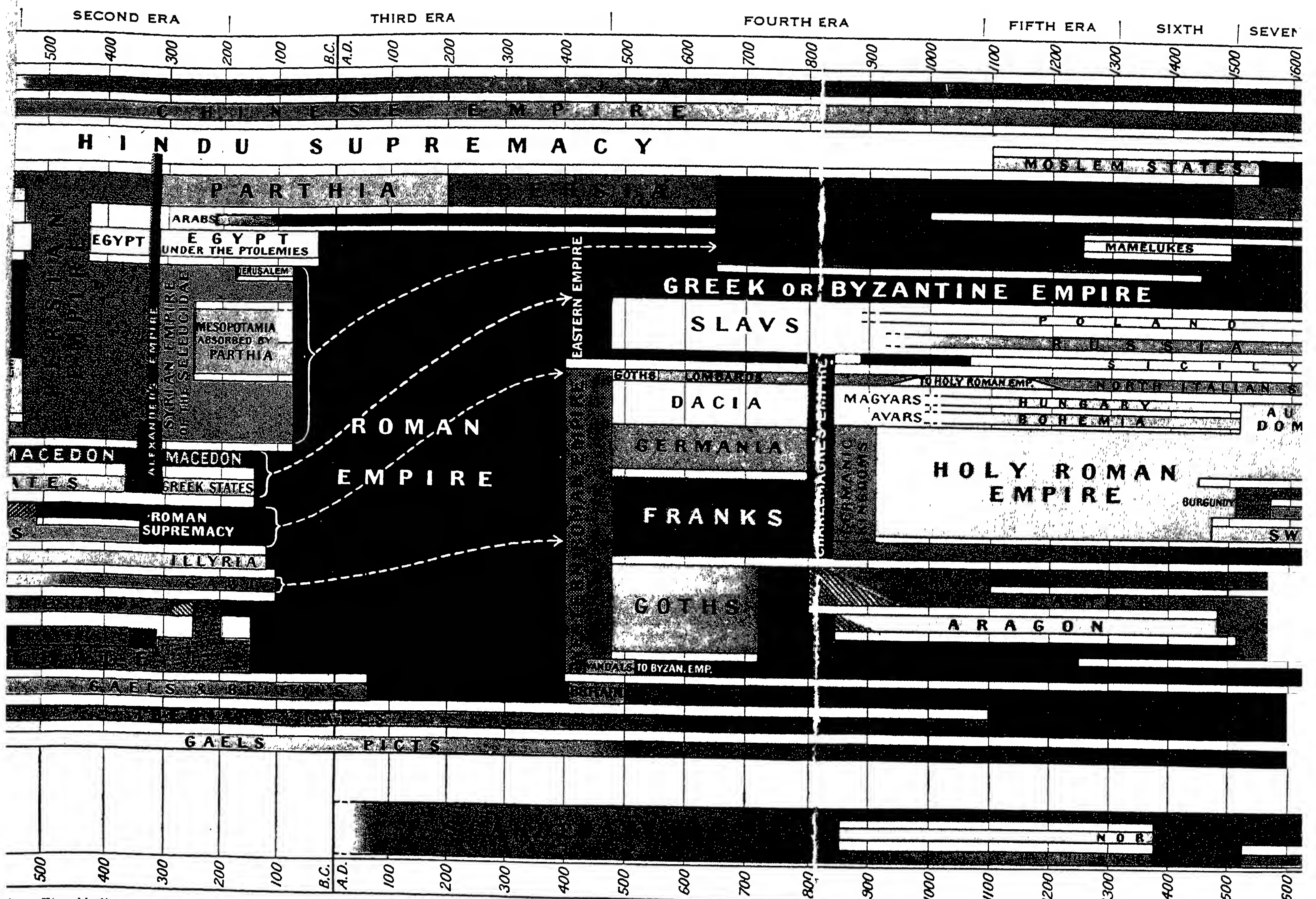
In 1580 B.C. a ruling class of foreign invaders was expelled from Egypt, and the rebound carried Egyptian arms as far as the Euphrates; but it was only from 1447 onwards that the potential empire thus created was methodically conquered and organized by the genius of Thothmes III. From the considerable details of its administration that have come down to us we are justified in calling this the world's first genuine empire. In the meantime an experiment in federation, under the leadership of the dominant tribe of Hatti, was being conducted in Asia Minor, and when, after about a hundred years, the empire of Thothmes crumbled away, the energetic Subbiluliuma took the opportunity of establishing a Hittite empire over Syria. Egypt revived and recovered some lost territory; but the position was one of stalemate.

World-movements of peoples swept away the Hittite Empire and jeopardised a degenerating Egypt in about 1200 B.C.; and in the resulting vacuum Phoenicia and the kingdom of David and Solomon could prosper. Of the 'Minoan' sea-power of Crete, later taken over by Mycenae, no historical details have been recovered.

The Hebrew kingdom split into rival halves (c. 945 B.C.). Like Babylon, the Phoenician cities were intent on trade alone; movements of Greek-speaking peoples into the Aegean area blotted the Minoan power from memory; Egypt was priest-ridden and impotent. A Phrygian kingdom was consolidating in Asia Minor, but apart from this the only virile power on the stage was Assyria. By methods too ruthless to be called imperial Syria and Palestine were absorbed, Babylon reduced to a vassal state, and finally Egypt conquered (671 B.C.); only towards the end was a system of Assyrian governors instituted. But new peoples were appearing; the Aryan Medes united with Babylon and in 612 wiped out the Assyrian name, thereafter dividing the empire with the Babylonians, while Egypt recovered independence.

In the West the Greeks were creeping round the Mediterranean. The Etruscans had appeared in northern Italy. Rome by tradition was founded in 753 B.C., Carthage in 850.

EMPIRE: CHART SHOWING THE RISE AND



The Median kingship had passed to the royal house of a cognate tribe, the Persians, and in 539 B.C. Cyrus the Great took over the Babylonian domains. Lydia, the successor of Phrygia in Asia Minor, fell to him, Egypt to his son Cambyses; Darius, scion of an allied house, organized these vast territories into what again we are entitled to call an empire in the full sense. But attempts to extend it to Europe were defeated by the Greeks.

Welded by the trial, the first political union of Greek city states emerged as the Athenian Empire. But interstate rivalries wrecked it, and unity was finally imposed from without by the half-Greek Philip of Macedon, whose son Alexander flung himself at the heart of Persia and won the greatest empire yet known; his death, however, was the signal for disruption. Seleucus obtained the greatest portion, the East, later curtailed by the Parthians.

Rome was winning ascendancy in Italy, and by 202 B.C. had fought out her struggle with Hannibal (Carthage).

Rome's first task had been to make herself mistress of Italy; the three problems being her Latin kinsmen, the Etruscan north, and the Greek south. Next, her defeat of Carthage gave her Sicily and Spain, and in the meantime Illyria was policed; the latter, together with Macedonian backing for Hannibal, led to interference in the East. Macedon was annexed in 168 B.C., "Asia" in 133.

After 100 B.C. Rome definitely stands forth as an imperial state; but in spite of the addition to her territories of the Seleucid domains (65), Gaul (59-50) and Egypt (31), the Republic was incapable of ruling the Empire. Augustus became Emperor in 31 B.C., and thereafter for 400 years almost all the known world was theoretically a single state from Atlantic to Euphrates.

Yet before the end of this period decay had set in. The Goths invaded Italy in A.D. 250; the Persian dynasty that succeeded the Parthians reoccupied much of Mesopotamia; Dacia had fallen away by the end of the century; and between 364 and 395 the Christianised empire definitely split into Western and Eastern halves.

The Byzantine Empire was destined to survive until the capture of Constantinople by the Turks in 1453. Some times with wide-flung dominions, some times with a meagre strip of territory but always fulfilling the rôle of Europe's bulwark against the East. In the West everything went to pieces under the shock of barbarian invasions. Jaries captured Rome in 410; Vandals and Visigoths flooded into Spain; Veodals into Africa; Franks and Alamanni into Gaul; Ostrogoths and Lombards into Italy; Saxons into Britain. Finally, the last puppet emperor was pensioned off in 476, only the Papacy carrying on the tradition of a world state. Charlemagne, king of the Franks, won pre-eminence and in 800 was crowned Emperor by the Pope, thus originating the idea of the Holy Roman Empire.

In the East, Islam started its career with Mahomet (570-632), and swept like a tide over Arabia, Syria, Persia, North Africa and Spain. The Caliphs first ruled from Damascus, then (750) from Bagdad, with a rival caliphate (780) in Spain; where Aragon and Castile maintained Christian independence in the north.

Imperialism during this period returned to the East. Afghan rulers established a Mahomedan dynasty at Delhi in India (1176); the Bagdad Caliphate disintegrated before Turkish invasions which consolidated into the Seljuk Empire; the Seljuks gave way to the Ottomans, who advanced their arms steadily into Europe.

In Europe the outstanding tendency was the growth of nationalism. England and France achieved nationhood precociously, the first because of its isolation, the second because of the hostile attentions of England. National spirit, in spite of political disunion, was fostered in Spain by the continual struggles against the Moors; Switzerland won independence from the Holy Roman Empire (1291); Tatar oppression rallied Russia round the princes of Moscow; Bohemia, Hungary, and Poland were consolidating since their adoption of Christianity in the tenth century. In Italy and Germany alone was disunion perpetuated by the Holy Roman Empire; actually a parcel of semi-independent cities and dukedoms, rent by the struggles between Pope and Emperor.

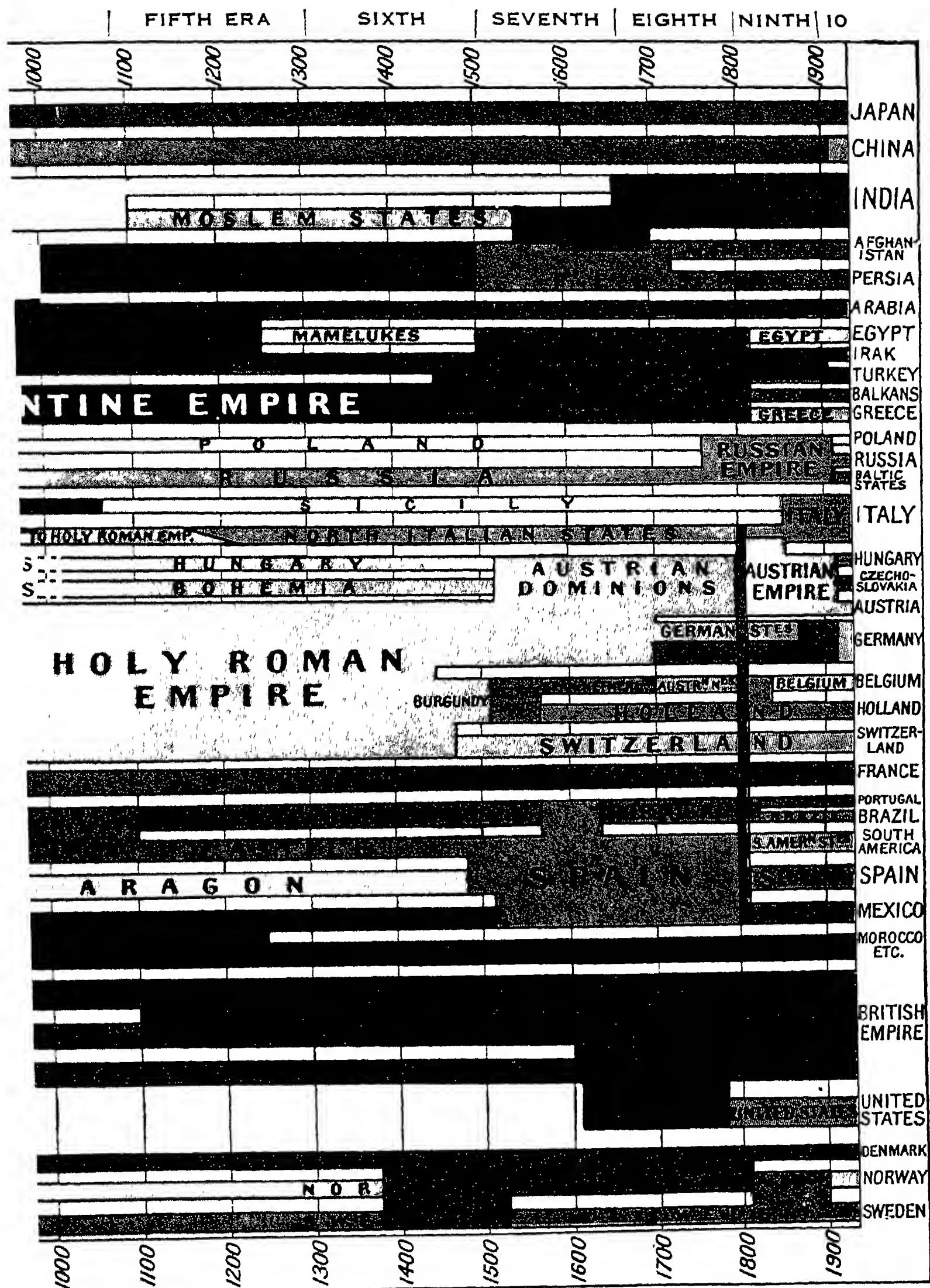
At this point history entered on a fresh phase with the discovery of the Cape Route by the Portuguese and the New World by the Spaniards, a Papal Bull granting dominion over the world outside Europe to these two powers—the West to Spain and the East to Portugal.

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FALL OF EMPIRES AND NATION STATES FROM THE DAWN OF HISTORY TO A.D.



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Spain made good much of her claim to the West, in spite of English and French colonisation; whereas the Portuguese grant was mocked, not only by English and Dutch, but by the existence of Turkish, Mogul, Japanese, and Chinese Empires. Meanwhile the Holy Roman Empire became centred on Austria, while Prussia achieved independence.

France and England took rank beside Spain as colonising powers. During the conflict between them the loss of the United States seemed to put an end to the British Colonial Empire; but with Canada, Australia, and the Cape it was rebuilt, while the acquisition of India resulted in an Empire of a different sort. Russia had become an empire in the full sense. Napoleon nearly made a French Empire of Europe; his failure left the Spanish Empire in ruins (S. American States), but the unification of Germany a potentiality, realized by the Franco-Prussian War. Italy was united in 1861-70.

The Turkish Empire in Europe was disintegrating; and the First Great War broke it up, together with those of Germany, Russia, and Austria. The Second Great War destroyed the empires of Italy and Japan and brought new independence to some of the Eastern possessions of Britain, France, and the Netherlands.

narrow, alternate leaves, and small, regular flowers, succeeded by fleshy berries. See Crowberry.

Emphysema (Gr., inflation). Condition in which the alveoli or air-cells of the lungs are over-distended with air and their walls atrophied. It is due mainly to long-continued increase of pressure of the air within the lungs and is most often seen in players on wind-instruments, glass-blowers, and sufferers from chronic bronchitis. Heredity plays some part.

Emphysema produces enlargement of the chest, which becomes barrel-shaped owing to arching of the ribs and sternum; the costal cartilages frequently become calcified, and movement of the ribs during respiration is much diminished, breathing being effected chiefly by means of the diaphragm muscle. The symptoms come on gradually, the earliest being some difficulty in breathing and feeling of "tightness" in the chest. The incomplete oxygenation of the blood may lead to cyanosis or blueness of the face. The disease may persist for many years, but gradually becomes worse. Death may occur from pneumonia, or the long-continued pressure in the lungs may lead to dilatation of the heart and dropsy. Medical treatment is not of much avail. Attempts have been made to increase the respiratory ventilation of the lungs by compressed air baths, etc.

Subcutaneous or surgical emphysema is a condition in which air finds its way into the tissues of the body, most often because of an injury which has resulted in an abnormal communication between an air-containing cavity and the subcutaneous tissue. In rupture of a lung, for instance, air may pass under the pleura or lining membrane, and spread up into the root of the neck and over the chest, producing swelling and a characteristic crepitation on pressure. Fracture of the frontal sinuses or air-cells may lead to subcutaneous emphysema in the forehead.

Emphyteusis (Gr.-Lat., implanting). Term of Roman law. It meant the right to enjoy the fruits of property belonging to another, on payment of a *pensio* or rent to the owner. It applied not only to land and houses, but to other property, e.g. slaves. The lessee might not allow the thing to deteriorate in value; and was bound to pay the rent whether the thing was beneficial to him or not.

Empire. Word derived from the Roman word *imperium* and meaning rule. It was used to describe the lands ruled by an emperor, the

most powerful of temporal rulers, who claimed to be superior to kings. The Roman empire founded by Augustus was succeeded by the medieval empire, known as the Holy Roman Empire, and by the Byzantium empire at Constantinople. In the 19th century there arose the Austrian, French, and German empires, and in the New World those of Brazil and Mexico.

The word is used also for large states of the E., and we speak of the Indian and Japanese empires. Moreover, the great states that existed before the Christian era are, for convenience, called empires, and we are familiar with a cycle of empires—those of Assyria, Persia, Macedonia preceding that of Rome. At present the tendency is to describe a federation of states as an empire. The succession of the world's great empires is graphically depicted in the colour plate.

Empire, HOLY ROMAN. Medieval institution that lasted from 800 to 1806. The Holy Roman Empire was born on Christmas Day A.D. 800, when Charlemagne was crowned emperor by the pope. It expired in 1806, when Francis II dropped the ancient title and called himself emperor of Austria.

From A.D. 475 to A.D. 800 Constantinople had been the seat of the lineal successor of the Roman emperors, whose supremacy in the W. had been a mere figment, while the bishops of Rome had asserted a claim to be the spiritual head of Christendom in defiance of the E. authority whether temporal or ecclesiastical. Charlemagne made himself effective master of W. Europe, and the defender of the papacy against its enemies; and, as at Constantinople the empress Irene usurped the imperial throne, the pope crowned the Frankish king as the heir of the Caesars and Roman emperor. The actual title, the Holy Roman Empire, was adopted by Otto I in 962.

The Dominions of Charlemagne

The new Roman Empire, then, was at first co-extensive with the dominions of Charlemagne. The British Isles were outside it; so was Scandinavia; and so was the greater part of Spain. Roughly speaking, the line of the Elbe and the Adriatic Sea marked its E. boundary. Under Charlemagne's successors it was parted into three portions: the Latinised West, which retained the Frankish name, and was ultimately shaped into the kingdom of France; the eastern or definitely German section, which was gradually extended till it em-

braced all the German and some of the Slavonic peoples; and the central portion, lying about the rivers Rhine and Rhône, and including the greater part of Italy, of which, however, a S. remnant continued to be attached to the E. empire.

In spite of the division between the princes of the Carolingian house, one was recognized as enjoying a sort of primacy, and he bore the imperial title. But the Carolingian dynasty wore itself out by the beginning of the 10th century in the eastern and middle kingdoms; with the result that France became independent, while the supremacy in the empire passed to an elected German king, who himself only bore the imperial title when he had been crowned in Rome. Fragments of the middle kingdom were attached to France, but the greater part of it was included in the empire.

The first German king was Henry the Fowler; under his son Otto the Great, the Holy Roman Empire was reconstituted. There was no hereditary right of succession to the German kingdom; but the descendants of a powerful emperor usually retained the succession for generations. The ruler was therefore German king by a mixture of election and descent, for the elected king was more frequently than not a son or near relative of the late ruler.

Great Congeries of Principalities

A custom grew up by which, in order to avoid an electoral struggle on the death of an emperor, the future emperor was designated during the lifetime of the reigning one, and he bore the title of king of the Romans. The Empire in fact was a great *congeries* of principalities large and small, lay and ecclesiastical, of which one of the princes was the official head, by right of election and by sanction of the exercise of physical force superior to that of rivals or recalcitrants. From the middle of the 10th century to the middle of the 13th the emperor is in the first place a German prince having a limited authority over the rest of the German princes. In the second place he is the legal overlord also of Italy; the tradition and title of the Empire fosters in the emperors a desire to be Roman Caesars rather than German Kaisers. Thirdly, the emperors incarnate the idea, but not the fact, of Christendom as a unity.

But beside the Empire as unifying Christendom stood the papacy, actually dominating the entire ecclesiastical organization of Western Christendom, claiming for the

pope a spiritual supremacy overriding that of the emperor as the temporal head of Christendom; and overriding that of all temporal authorities whatever within their own dominions. Theoretically, the papacy did not claim to exercise control over things temporal. But practically the lay and ecclesiastical interpretations of the spiritual and temporal spheres of control differed and overlapped, so that there was an endless contest of authority. Thus we have the emperors in their fourth aspect, as the supreme representatives of secular authority in antagonism to ecclesiastical authority, in the contest between Church and State.

Guelfs and Ghibellines

The Saxon emperors, Henry and the three Ottos, finally rolled back or stemmed the advance of more barbarian races on the E., and penned the Magyars into Hungary. They dominated the papacy, nominating several of the popes. They were followed in the 11th century by the Franconian or Salian series, Conrad II and Henry III, IV, and V. The reign of Henry IV was marked by the struggle between the emperor and Pope Gregory VII, with whom begins the great period of papal domination. With Henry's death the rivalry opened in Germany between the Saxon house of the Welfs, or Guelfs, and the Swabian house of the Hohenstaufen.

The Swabians secured the imperial crown for some generations; hence the anti-imperialists in Italy adopted the name of Guelf as a party title, while the imperialists were called Ghibellines. The emperor Frederick Barbarossa (1152-90) was worsted in his struggle with the popes, while the cities of Lombardy succeeded, after a hard struggle, in securing their liberties; but in Germany he broke the power of the Guelfs and established his own supremacy, which was maintained by his successor, Henry VI. Henry, by his marriage, acquired the kingdom of Sicily; his son, Frederick II, the last Hohenstaufen emperor, succeeded to the empire after an interval of contest between other rivals. But he was in effect a Sicilian, not a German. His reign and the strife which preceded it destroyed what Frederick I had done towards the unification of Germany itself. Frederick II's death in 1250 was followed by the great interregnum during which no imperial authority was recognized. It was brought to an end by the election of a minor prince, Rudolph of Hapsburg, 1273, who laid the foundations of the greatness of that famous house.

The medieval European system was now breaking up. The papacy lost prestige by its transference from Rome to Avignon. The imperial crown passed from one house to another; from Hapsburg to Luxemburg, from Luxemburg to Bavaria, from Bavaria back to Luxemburg. It was at this time that a group of German princes were definitely established as the electors with whom alone lay the right of fixing the imperial succession. Sigismund, son of the emperor Charles IV, acquired the kingdom of Hungary by marriage, though it was not brought within the imperial bounds as was Bohemia. With Charles IV the efforts of German rulers to maintain their position in Italy came to an end.

The reign of Sigismund, during the early part of the 15th century, is chiefly notable for the reinstatement of the papacy after the great schism at the council of Constance (1414-18), and also for the establishment of the first Hohenzollern margrave of Brandenburg, the progenitor of the kings of Prussia.

On Sigismund's death, in 1437, Albert of Hapsburg became king and emperor; and from his day until 1806 a Hapsburg was, with one exception, at the head of the Holy Roman Empire.

Effect of the Thirty Years' War

In 1519 Charles V succeeded his grandfather, Maximilian I, as emperor. His reign is contemporaneous with the development of the Reformation. The hereditary Austrian and other German estates of the house of Hapsburg were transferred to Ferdinand, the brother of Charles, and he succeeded his brother as emperor in 1556. The pacification of Passau, procured mainly by his agency just before his accession, gave Germany peace for some 60 years by establishing a compromise between the Roman Catholic and Protestant princes. The attempt of Charles V to establish the personal supremacy of the emperor throughout Germany, failed; German princes, big and little, were nearly independent sovereigns.

In the 17th century Ferdinand II, in the Thirty Years' War, sought to bring the Protestant princes into subjection, while Wallenstein, careless of the religious question, sought by means of the war to make the emperor absolute monarch of Germany. Both attempts failed. After the Thirty Years' War (1618-48), the independence of the greater German princes was an established fact, while the still nominal imperial authority was little more than a

fiction. The struggle of the next 100 years between Bourbon and Hapsburg was not a struggle between the Empire and France, but between the Hapsburgs and France. Although the war of the Austrian succession included a contest for the succession to the imperial crown between the Bavarian claimant, Charles Albert, and Maria Theresa, the representative of the Hapsburgs, that was altogether a minor aspect of the struggle.

End of the Holy Roman Empire

Charles Albert was made emperor, but on his death the crown reverted to the Hapsburgs in the person of Francis of Lorraine, whose son Joseph II again aimed at establishing an imperial ascendancy by the consolidation of Hapsburg dominions within Germany. The attempt, however, collapsed when Frederick II of Prussia formed the Fürstenbund (League of Princes) to maintain the constitutional rights of the German princes—which meant in effect their freedom from any recognizable imperial control.

In 1792 the French Republic went to war, not with the Empire, but with Austria. It was Austria, not the Empire, which was brought to submission by Bonaparte in 1797, again by Moreau at the battle of Hohenlinden in 1800, and by Napoleon at Austerlitz in 1805, when Napoleon had already proclaimed himself emperor. There was no longer any plausibility in maintaining the pretence that there was one imperial head of Christendom, and in 1804 the Emperor Francis assumed the title emperor of Austria.

The history of the Holy Roman Empire down to the 16th century is, in respect of one part of it, identical with the history of Germany, and, in respect of another part, is intimately bound up with the histories of Italy and of the papacy. In the 16th century it is practically the history of Germany; the emperor is the German emperor with no pretensions to being the Roman emperor or the head of Christendom. From the middle of the 17th century the emperor is the Austrian emperor; the German or Holy Roman Empire exists only in name, with the survival of constitutional forms, until even the name disappears in 1806. See *Charlemagne*; *Electors*; *Golden Bull*; *Papacy*; consult also *The Holy Roman Empire*, J. Bryce, 1864 and later; *The Empire and the Papacy*, T. F. Tout, 1898; *The Medieval Empire*, H. A. L. Fisher, 1898; *The Close of the Middle Ages*, R. Lodge, 1901. **A. D. INNES**

Empire Air Training Scheme. Wartime scheme for training British and Empire airmen in the Dominions. Set up by an agreement signed at Ottawa, Dec. 17, 1939, between Great Britain, Canada, Australia, and New Zealand, this scheme provided for the training of airmen from these dominions and from Great Britain at schools established in New Zealand, Australia, and Canada, but principally in the last, because of its size and comparative proximity to Great Britain. It was devised to avoid the difficulties of air training in Great Britain, due in particular to that country's vulnerability to air attack. Most of the initial cost was borne by the dominions concerned, but the agreement provided for the reimbursement of their governments on the basis of the number of airmen trained. New Zealand gave elementary training to her own nationals, and Australia provided both elementary and advanced training; airmen from both received final flying training in Canada.

The four commands in Canada were centred at Montreal, Toronto, Winnipeg, and Regina. Each was sub-divided into elementary and service flying schools, observer, navigation, bombing, and gunnery schools, and engineering and technical training schools. Originally most of the instructors came from the U.K., but soon a central training school for instructors was opened at Trenton, Ont. By the end of 1940, 48 training schools in Canada were capable of producing 20,000 pilots and 30,000 other members of air crews per annum. Training absorbed 4,100 aircraft. These figures were later considerably exceeded. The first pilots to complete their training in Canada arrived in England in Dec., 1940.

Australia provided training for 10,000 pilots and 15,000 gunners, observers, and wireless operators over a period of three years, building 35 training schools for the purpose. The scheme was closed down in March, 1945.

Empire Day. British imperial celebration held annually on May 24, anniversary of Queen Victoria's birthday. The first celebration was in Canada in 1897, being organized at Hamilton, Ont., as a means of popularising Empire study among school children. The Dominion Teachers Association adopted the celebration, and thereafter Empire Day was held throughout Canada on May 23, May 24 being already a

school holiday. In 1902 the earl of Meath suggested an Empire Day celebration throughout the Empire and wrote to all prime ministers and governors within it outlining his plans. The first Empire-wide celebration was in 1904. The aim was to introduce a training that would produce patriotic citizens of the Empire, special prominence being given to saluting the flag. In 1921, at Lord Meath's request, the Royal Colonial Institute, now the Royal Empire Society (*q.v.*), undertook responsibility for the movement.

Empire Free Trade. Campaign for the adoption of free trade within the British Empire initiated by Lord Beaverbrook (*q.v.*) in 1929. Its object was the imposition by Great Britain of duties on meat, wheat, and other commodities from foreign countries, but not from the dominions, and the reciprocal admission by the dominions of British manufactured goods free of duty. Although the campaign earned some support from farming communities in the dominions, it was generally rejected by the dominion governments, whose policy was to encourage the development of local manufacturing industries.

Empire Gallantry Medal. British decoration, replaced by the George Cross in Sept., 1940. The E.G.M. was awarded to 61 military personnel and 68 civilians between 1923 and 1940, those holders living when the change was made receiving the George Cross in its place. Posthumous awards of the E.G.M.



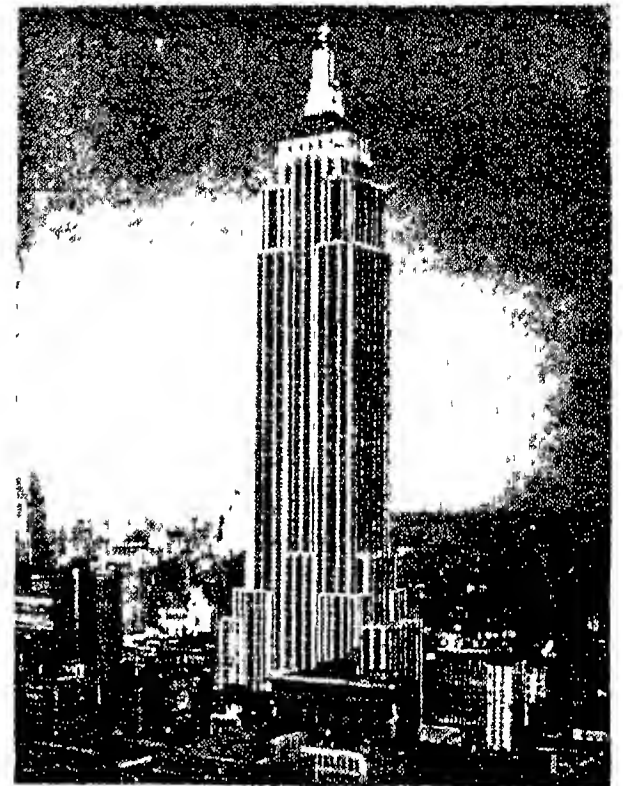
Empire Gallantry Medal

made during the Second Great War were similarly replaced. The ribbon of the civil division was plain purple, that of the military division having a yellow vertical stripe down the centre. The medal was of silver, with "gallantry medal" inscribed on the reverse and "For God and the Empire" round the circumference.

Empire Powder. Smokeless sporting propellant manufactured by Nobel's Explosives Company. It is of the type designated 33-grain powder, the nomenclature signifying that this weight of propellant is the normal charge for a 12-bore gun, and comparable to the standard charge of 82 grains of black gunpowder. It

consists essentially of nitro-cellulose, containing about 12.5 p.c. of nitrogen, with small quantities of barium and potassium nitrate. Powders of this type are greatly valued for the low rate of recoil imparted to the gun. See Explosives; Smokeless Powder.

Empire State Building. Skyscraper in New York City. Pending the completion of the Palace of the Soviets, Moscow, it was the tallest building in the world. Completed in 1931, the building,



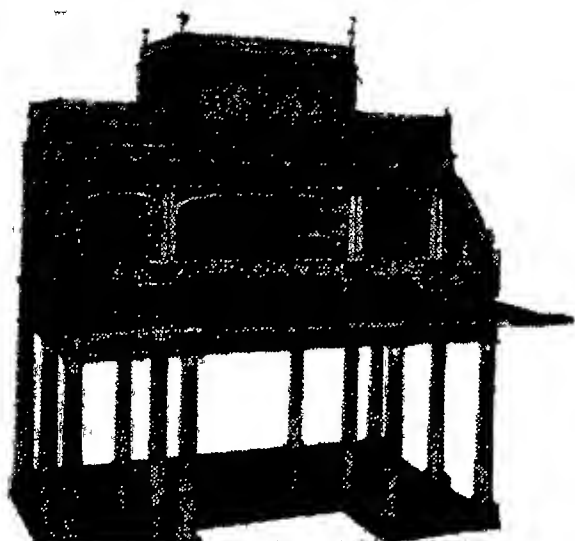
Empire State Building, New York. It is 1,248 ft. high

named after the "Empire State" (New York), rises from the junction of Fifth Avenue and W. 34th Street, and is 1,248 ft. high. The television transmission mast surmounting it brings the total height to 1,472 ft. There are 102 storeys above street level, two below. On the top floor are an air-conditioned restaurant and an observation gallery. On July 28, 1945, a U.S. army bomber crashed in mist into the 79th storey. In the crash and fire that followed 13 people were killed.

Empire Style. In decoration and furniture, a development of the Directoire style, an outcome of the admiration felt by the leaders of the French Revolution for Greek and Roman culture. The Directoire style was severely classical in outline and decoration. A rectilinear outline was adopted, legs of tables and chairs were straight or tapered, round and fluted or reeded. Classic mouldings, capitals, and pediments, with a few republican symbols and animal masks, were the principal decorative commonplaces.

With the Empire some of the solidity and simplicity of the Directoire disappeared. The furniture was rather light in

construction, and while the straight line was the rule in contour, curved lines were introduced in the decorative designs, such as wreaths of laurels, olive, and palm, dainty ribbon bows, and lyres. Imperial



Empire Style. Writing-desk showing decoration typical of this period

symbols, such as the eagle, bee, and crowned N, replaced the republican designs, while the sphinx was also used. Medallion portraits and figures (painted, enamelled, or porcelain plaques) were used, together with heavy gilded mountings of classic design. Much of the furniture was painted white, or gilded. White, gold, crimson, and dark blue were adopted for upholstery and hangings. The tripod and X legs are often seen. See Furniture.

Empiricism (Gr. *empeiria*, experience). In philosophy, the theory that regards experience as the only source of knowledge. It is closely akin to sensualism, the theory that all knowledge is only transformed sensation. The Stoics occupied a position midway between empiricism and idealism (*q.v.*), in that they considered the impressions made upon the soul through the sensations to be alone certain, but held that the truth or falsehood of these impressions depended upon their being characterised by an arresting power of conviction.

The founders of empiricism in modern philosophy are Hobbes, who maintained that all knowledge comes from the senses and that the activity of the mind merely consists in combinations of words, and Locke, according to whom the mind is a blank slate indebted for all its knowledge to the senses, which give it sensation and the perception of external objects, and to reflection which is exercised upon the operations of the mind. In more recent times its chief upholder is John Stuart Mill. See Philosophy.

Employers' Liability. Liability of an employer for injuries to his employees while acting in his employment. In the early

19th century, the increase in the number of factories, and the many accidents which took place then, would have imposed enormous liabilities on employers if they had been held responsible where the negligence of an employee caused injury to a fellow-employee. Accordingly the courts developed the doctrine of common employment under which an employer was not liable for the negligence of an employee when the person injured is a fellow-employee engaged in common employment with the employee who caused the injury. The Employers' Liability Act, 1880, provided that common employment should not be a defence to an employer where the employee injured was engaged in manual labour (other than domestic service) and the injury was due to (1) defects in machinery or plant; (2) negligence of superintendents (*e.g.* of a foreman); (3) improper bye-laws or instructions. On the railways, the doctrine was not a defence in the case of injuries caused by negligent management of signals, points, and trains.

The Workmen's Compensation Acts, the first of which was passed in 1897, provided that in the case of an employee engaged in manual labour or earning not more than a certain sum (£420 a year when the Acts were repealed in 1946) the employer should be liable to pay such employee compensation in the form of weekly payments for incapacity, and a lump sum, limited in amount, for death, for all injuries arising out of and in the course of his employment except injuries due to his own serious and wilful misconduct; and, if the injury caused death or permanent disablement, compensation was payable even if the injury was due to misconduct. Common employment was no defence to a claim under these Acts.

The employer might further be liable for injuries caused to an employee by some breach by the employer of some statutory duty—*e.g.* the duty to fence machinery under the Factory Acts, and to such a claim common employment was not a defence. Here again the claim was for a lump sum.

In 1946, the National Insurance (Industrial Injuries) Act, repealed the Workmen's Compensation Acts. For the resulting changes in the law relating to employers' liability, see Insurance, National.

Employment Exchange. Employment exchanges, totalling 540, with their subsidiaries, 483 em-

ployment offices, 181 branch employment offices, and 205 local agencies, form the local administrative units of the Ministry of Labour and National Service. Their work is co-ordinated by 11 regional controllers, and they deal directly with the public on matters not reserved for regional treatment. Of these employment exchanges, 113 are called allocation local offices, and to these are sent the registration forms of all men and women registering for military service. Action is taken, including medical examination, up to the point when the recruits are immediately available for posting for military duties. The actual call-up is done by the regional officer.

Within each employment exchange, and employment office, separate departments deal with men and women, and also with juveniles, where these are not dealt with by the local education authority.

The work of the employment exchanges consists chiefly of matters relating to the following: (a) Supply of labour and employment, including recruitment of trainees for government training centres; (b) The National Service Acts, including registration for national and military service; (c) Claims for unemployment benefit, applications for assistance, proof of unemployment, payments to refugees, issue of unemployment books and regulations; (d) Adjudication on claims to benefit; (e) Finance, including impresting for cash for benefit payments, issue of rly. warrants, payment of subsistence and lodging allowances, and compilation of man-power statistics.

Attached to most employment exchanges are local employment committees composed of representatives of employers and of workers. These act as advisory bodies to secure the benefits of local knowledge, and close co-operation between local exchanges, employers and applicants. At employment exchanges in large towns, juvenile advisory committees, composed of representatives of education authorities, employers, and youth organizations, advise on the first placings of children about to leave school. In many cases, special meetings of children are arranged, and advice and information are given by competent speakers. The secretary of the juvenile advisory committee arranges to be represented at the after care meetings held at each

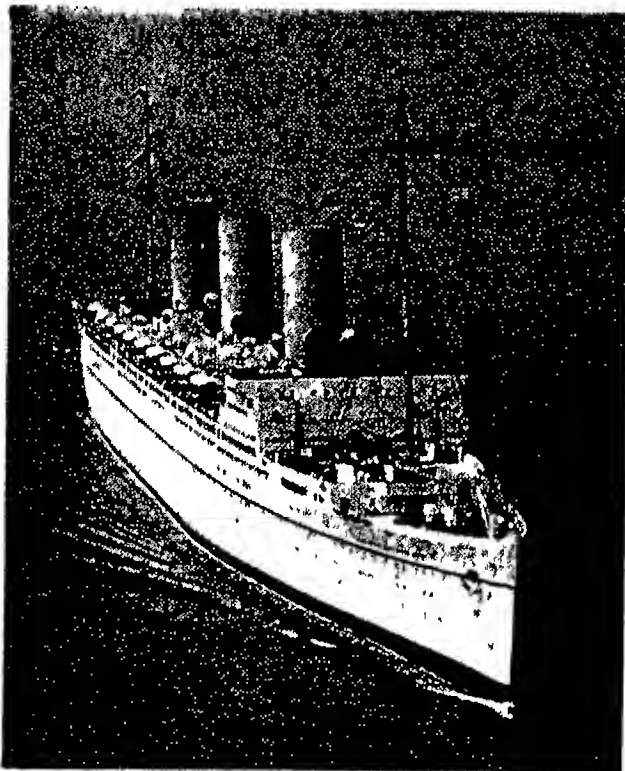
school to advise scholars seeking employment.

Historically, employment exchanges are developments of the labour exchanges organized by local authorities under the Workmen's Unemployment Act, 1905, as a clearing house for vacancies and applicants. National labour exchanges were set up by the Labour Exchanges Act of 1909 and placed under the direction of the Board of Trade. These undertook the administration of the unemployment section of the National Insurance Act, 1911. During the First Great War the number of insured persons rapidly rose, and a large surplus accumulated in the unemployment fund. The growing importance of the work of the employment exchanges led to the establishment of a ministry of Labour in 1916. After the First Great War, the exchanges experienced their most difficult period. Administering in trying circumstances a succession of acts designed to alleviate increasing unemployment, they did much constructive work in promoting transfers, and organizing and conducting training schemes to enable workers to fit in with the new conditions. Just before the Second Great War they became the national service offices, issued the service handbook to all citizens, and the schedule of reserved occupations. The employment exchanges became the integral machinery for the mobilization of the nation's man and woman power. In normal times, employment exchanges play an increasing part in local life. Their activities touch the lives of almost everybody above school-leaving age. They help to divert labour towards industries where it is needed, and on their returns is based that necessary adjunct to the financial budget, a manpower budget.

Empoli. Old town of Italy in the prov. of Florence. It stands on the Arno, 20 m. by rly. W.S.W. of Florence, in a fertile district. The collegiate church, founded 1093, was destroyed in the Second Great War; its pictures are mostly housed in a neighbouring gallery. The church of S. Agostino was seriously damaged. Jacopo Chimenti, the painter, was a native. Empoli has manufactures of cotton, leather, glass, and art pottery. Indian troops of the British 8th army entered Empoli on Aug. 5, 1944, the Germans subsequently withdrawing across the Arno. Pop. (1951) 29,081.

Empress. Feminine of emperor. It is a corruption of the Latin *imperatrix* and is applied by courtesy to the wives of emperors, as well as to the few women who have ruled over an empire. Maria Theresa was an empress (Ger. *Kaiserin*), and Queen Victoria was empress of India. The women rulers of the Byzantine empire, Irene, for instance, and Catherine and Elizabeth of Russia, are also known in English as empresses. See Emperor; Sovereignty.

Empress of Britain. British liner of 42,348 tons completed in 1931 as flagship of the C.P.R.



Empress of Britain. C.P.R. liner sunk by the Germans in 1940

fleet. In 1939 she brought King George VI and Queen Elizabeth back to England after their tour in Canada and the U.S.A. On Oct. 25, 1940, the Empress of Britain was badly damaged by German bombers when 150 m. off the Irish coast. Taken in tow by Admiralty tugs, she was sunk on Oct. 27 by a German submarine.

A new Empress of Britain, 24,000 tons, launched by Elizabeth II in 1955, made her maiden voyage in 1956.

Empress of Ireland. Passenger steamer belonging to the C.P.R. On May 29, 1914, bound from Quebec to Liverpool with 1,367 people on board, she was rammed by the Norwegian collier Storstad in the St. Lawrence river during a fog. The liner sank in ten minutes, and 934 persons went down in her, including the actor Laurence Irving.

Empson, SIR RICHARD (d. 1510). English lawyer. Born at Towcester, Northants, he became M.P. for that county, and speaker of the house in 1491, and, knighted in 1504, was made chancellor of the duchy of Lancaster. A favourite of Henry VII, he col-

laborated with Edmund Dudley in that king's obnoxious fiscal policy, and became universally unpopular for his harshness. After Henry VIII's accession he was tried on a charge of constructive treason, attainted by parliament, Jan. 21, 1510, and beheaded with Dudley on Tower Hill, Aug. 17, 1510.

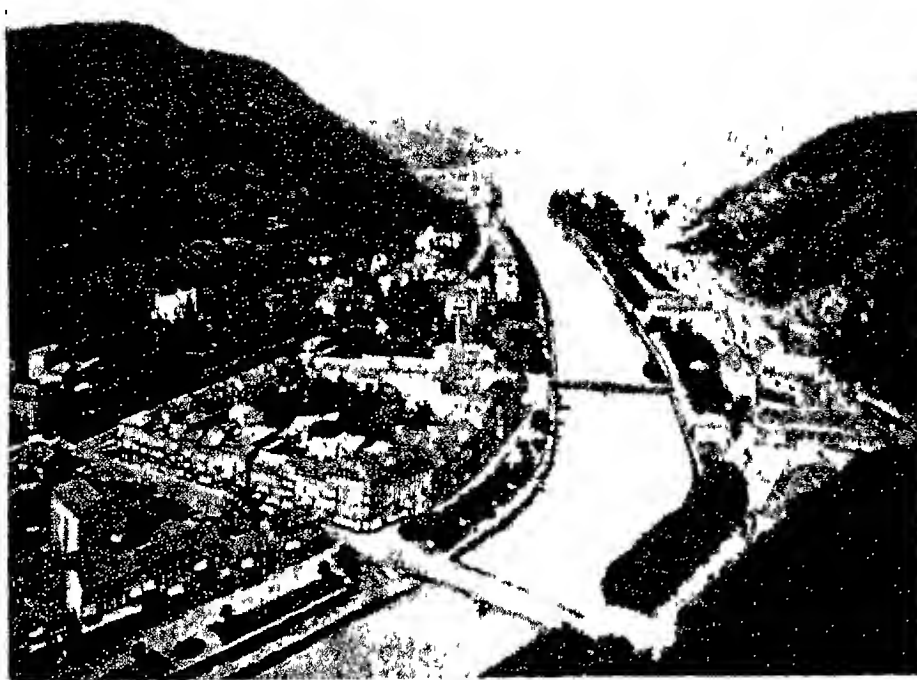
Empyema (Gr., suppuration). Collection of pus in the pleural cavity—that is, between the layers of membrane lining the chest wall and the lung. The condition may be due to infection from within, following simple pleurisy or septic pneumonia, or sometimes tuberculous broncho-pneumonia; less frequently to infections from without, as a result of fracture of a rib or a penetrating wound of the chest. The onset may be sudden, with pain in the chest, sweating and rise of temperature, but when, as usually, the condition develops in the course of simple pleurisy or a morbid condition of the lung, there is no marked line of separation in the symptoms.

Empyema is a serious condition, and if left untreated is likely to prove fatal. In mild cases it may be sufficient to draw off the pus by aspiration, but generally it is necessary to secure thorough drainage of the pleural cavity by making an opening between the ribs or removing a portion of a rib so that a large drainage tube can be inserted. This causes collapse of the lung on the affected side, but if the operation has been performed early there is a good prospect of the lung re-expanding after the discharge has ceased and the wound has healed.

Ems. River of Germany. It rises in Westphalia, in the Teutoburger Wald, and flows mainly in a N. direction through N. Rhine-Westphalia and Lower Saxony to the Dollart, an opening of the North Sea. It is about 210 m. long; its chief tributaries are the Aa, Haase, Hessel, and Leda. It has been canalised as part of the system of German waterways. Emden is at its mouth. See Dortmund-Ems Canal.

Ems. German town and spa, on the river Lahn, 8 m. from its confluence with the Rhine S. of Coblenz. It has powerful and famous alkaline and ferruginous waters, used for drinking and bathing cures at least since the 14th century; the waters have a natural temperature of 85°–120°F., and were bottled and dispatched to many countries. A pleasant town of some 7,500 inhabitants,

Ems is situated between wooded hills offering attractive walks; it has a kursaal, theatre, many hotels and nursing homes, etc., and visitors staying for cure of cararrh, asthma, or diabetes between the two Great Wars averaged 10,000 a year. Ems passed from Hesse-Nassau to Prussia in 1866.



Ems, Germany. Town and bathing-place standing in the valley of the river Lahn

In 1786, by the Punctation of Ems, the German bishops made an unavailing attempt to throw off their allegiance to the pope; and in 1870 the Ems Telegram (*v.i.*) provoked the Franco-Prussian War.

Ems Telegram. Message published by Bismarck in 1870 which was the immediate cause of the Franco-Prussian War. France had just succeeded in obtaining the withdrawal of Leopold of Hohenzollern as a candidate for the throne of Spain, but put forward a further demand. On July 13, 1870, Benedetti, the French ambassador, interviewed King William I, who was staying at Ems, and requested a promise that he would not allow the candidature to be renewed. The king refused, and later in the day declined to reopen the discussion. To Bismarck at Berlin he sent an account of the proceedings, and this was the Ems telegram.

Bismarck thereupon published the telegram with certain alterations, especially in that part of the message in which the king informed Benedetti that he could not discuss the matter further. These made it appear that instead of this being merely a courteous refusal to reopen the matter, it was a dismissal of the ambassador from his presence. Thus it was treated by France as a *casus belli*. The vital sentence was "His majesty refused to receive the French ambassador, sending word that he had nothing more to communicate."

Emsworth. Seaport of Hampshire, England. It stands at the mouth of the Ems, a small stream. It is 9 m. N.E. of Portsmouth, and has a railway station. The port has a coasting trade and oyster beds. Pop. 3,500.

Emu (Port., *ema*, ostrich) (*Dromaeus novae hollandiae*). Large bird belonging to the division Ratiatae. It is found only in Australia

and certain neighbouring islands. The second largest bird now living, it is exceeded in size only by the ostrich, which it somewhat resembles in general build. But the wings of the emu are more rudimentary, and the bird depends entirely on its swiftness as a runner to escape its foes. The slender feathers are brown, mottled with grey, but the younger birds bear longitudinal stripes of lighter colour. Emus are rare except in



Emu. Second largest bird known, it is peculiar to Australia
Gambier Bolton, F.Z.S.

the wilder parts of the country, where they live in small flocks and feed chiefly upon small fruits. Although not web-footed, they swim well, and take to the water readily. They are hunted with dogs, and when brought to bay can deliver serious kicks. These birds are easily domesticated, and breed readily in captivity. The male, smaller than the female, incubates the eggs, which are green.

Emulsin (Lat. *emulsus*, milked out) OR SYNAPTASE. Name given to enzymes (*q.v.*) which hydrolyse glycosides of the beta series. Emulsin occurs in plants, *e.g.* fruit kernels, leaves, mould fungi, and bacteria. Its action on the amygdalin present in bitter almonds produces essential oil of

almonds in the process of manufacturing the expressed oil. Emulsin may be made from an aqueous extract of almonds by precipitation with alcohol and subsequent purification.

Emulsion. Substance formed when droplets of one liquid are dispersed in another liquid, each liquid being insoluble in the other. The addition of a third substance, called the emulsifying agent, is generally necessary to prevent the droplets from coalescing. The emulsifying properties of yolk of egg and gum arabic have probably been known to mankind for centuries. The number of emulsifying agents used in industry is being added to continually. They are used in agricultural sprays, in the textile and leather industries, in cleaners, soaps, cosmetics, and pharmaceutical preparations, foods, paints, and polishes.

A photographic emulsion is the term given to the light-sensitive layer either in the solid form on its support of glass, film, or paper, or in the liquid form before application thereto. It is more correctly described as a photographic suspension, being the dispersion of a solid in a liquid phase. The emulsifying agent is usually gelatine or collodion (*q.v.*). The essential constituent is one of the silver halides, chloride, bromide, or iodide, or a combination of these, precipitated in the dispersion medium. Sensitiveness to differing regions of the spectrum is attained by treatment of the emulsion with various dyes. After "ripening" and "digestion," two processes which affect contrast and other characteristics, the emulsion is cooled and set, being further modified before final coating. See Photography.

Enabling Act. Popular name for the National Assembly of the Church of England (Powers) Act, which became law in 1919. It was introduced by the archbishop of Canterbury, the object being to set up for the Church of England a national assembly with considerable powers for the government of the Church (see Church Assembly). The Act set up a roll of electors in each parish. (See Electoral Roll.) The various diocesan conferences elect the members of the house of laity. See Convocation.

Enamel. Transparent or opaque glassy substance applied to metal or other surfaces in the form of a paste and then fired to fix it. The material—ground very fine, mixed with gum, water, or oil of spike to

render it adhesive, and reduced to a pasty consistency—is brushed on to the object, which, when duly decorated, is placed in a furnace. In pots, pans, and culinary utensils an internal lining of enamel protects the iron body from oxidation when exposed to heat and wet or from corrosion by acids. The metal, after having been annealed to bear the heat, is dipped into the glaze and fired in a furnace at 1,500° F.

In the fine arts enamel is principally used in connexion with pottery and porcelain wares, jewelry, watches, snuff-boxes, plaques, and articles for the toilet table. The enamel may be applied by the enclosed method of *cloisonnée* (*q.v.*), the engraved or incised method or *champlevé*, and the surface method, in which the whole surface is covered with enamel on which the design is delicately painted and fired. Coloured enamels were used by the Egyptians, the Greeks, and Romans, but the art was brought to a high state of perfection under the Byzantine emperors. A special style was developed among the Orientals, while a kindred art of polychoured enamelling was carried out extensively in N. Europe. Of the surface style the enamels for which Battersea was noted in the 18th century are an example, while in Limoges enamel, which was a variety of surface work, painting was carried to rare perfection by the practitioners of the 16th cent. Copper was the metal most employed for this purpose, but gold and silver were sometimes used.

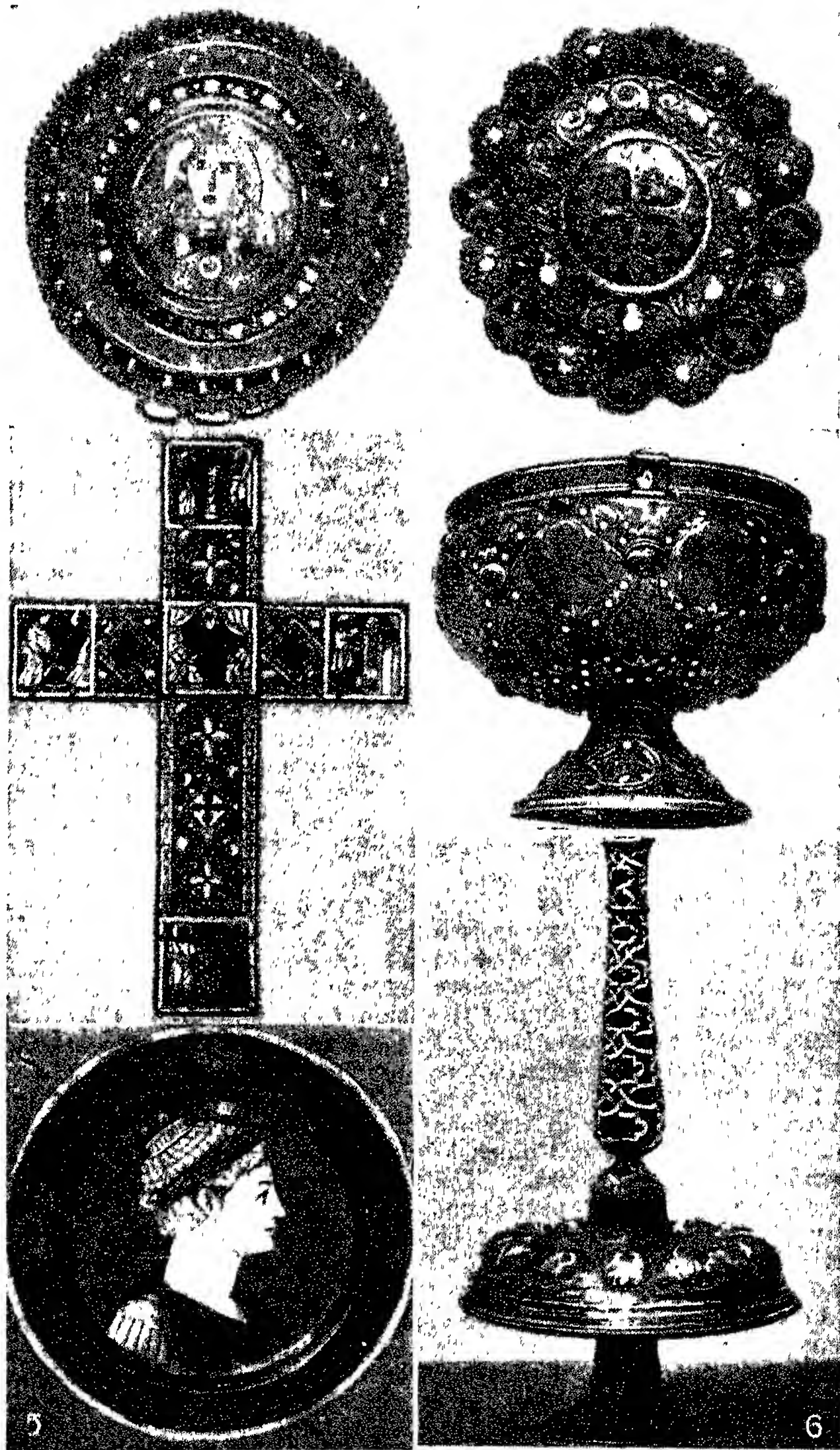
Enare. Lake in Finland, in the N. of the department of Oulu. It is fed by a number of rivers, and discharges its waters through the Pasvik into the Varanger Fiord in the Arctic Ocean. Its area is 550 sq. m. *Pron.* Enah-re.

Enarea. Plateau region of Abyssinia, S.W. of Shoa. It has hills attaining an elevation of 8,000 ft. above sea level, upon the slopes of which coffee grows in abundance. The people are an off-shoot of the Gallas. The chief town is Saka, near the Gibbe river.

Enargite. An orthorhombic copper mineral, chemically copper arsenic sulphide, Cu_3AsS_4 , with minor amounts of antimony and iron. It occurs as greyish black tabular or prismatic crystals with a perfect cleavage; also massive or granular. Enargite is found typically in vein and replacement deposits formed at moderate temperatures with other copper minerals; *e.g.* at Butte, Montana.

Encaenia (Gr. *en*, in; *kainos*, new). Feast of dedication or renewing. It is used especially for an anniversary of the dedication of a church or temple. Among the Jews it is applied particularly to the anniversary festival of the dedication of the temple at Jerusalem. At Oxford university, Commemoration, the festival at the end of the academic year, when founders and benefactors are commemorated, is also known as Encaenia.

Encalada, MANUEL BLANCO (1790–1876). Chilean soldier and diplomatist. He was born at Buenos Aires, and having been educated at Madrid and the naval academy at Leon, returned to S. America, where he joined the revolutionary party. He was with Cochrane (10th earl of Dundonald, *q.v.*) in his Pacific campaign as commander of the Chilean navy. In 1853 Encalada was appointed Chilean minister to France. He died Sept. 5, 1876.



Enamel. 1. Gold brooch with bust in cloisonné enamel, Italian, c. 7th century. 2. Gold brooch of German make with Byzantine cloisonné enamels, 11th cent. 3. Enamelled cross, attributed to Godefrid de Clare of Huy, late 12th cent. 4. Ciborium of Limoges work, 13th cent. 5. Plate in brilliant colours of Limoges work, c. 1530. 6. Pillar candlestick, Limoges, c. 1560

Encarnacion. City of Paraguay. The capital of Itapua dept., it stands on the Paraná. 230 m. S.E. of Asunción, with which there is river connexion. It is the terminus of the Paraguay Central rly. and connected by ferry with Posadas in Argentina. The centre of the cattle industry, it produces hides, also yerba maté and tobacco, and has cotton gins, sawmills, and flour mills. Pop. (est.) 40,000.

Encaustic (Gr. *enkaustikos*, burnt in). Method of painting with colours and wax, said to have been invented by Polygnotus (5th century B.C.) and much practised by the ancient Egyptians and Greeks. Their technique is not definitely known, but it is surmised that coloured powder was mixed with white wax and kneaded into small cakes. When required metal disks with cuplike indentations were heated and a cake was laid on the palette, a different colour in each depression, and gradually melted. The process was rapid, for the wax, laid on with a brush, cooled quickly and the work had then to be touched again with moderately hot irons, which fused the tints.

Encephalitis. Inflammation of the brain. This may occur as a primary condition due to an attack by a virus as in encephalitis lethargica or sleepy sickness; or it may be the result of injury, spreading abscess, or syphilis. Headache, coma, irritability, convulsions, and vomiting are common to all forms. Paralysis and over-irritability of muscle groups localise for the physician the severity and site of the lesion.

Encephalitis lethargica is an infection of the nervous system by a virus which is believed to travel to the brain via the nerve fibres themselves. Thereupon the virus, unable to get out, is caged within the nervous system, where it may survive for long periods, giving rise to lapses of nervous balance. The onset has much in common with influenza. The disease never leaves the patient undamaged, and often there may be serious alteration in personality and deterioration of moral fibre.

Cerebral abscess is never a primary condition, but travels from some infective focus, frequently in the ear or throat, or from suppuration in the chest or distant bones. Injuries to the skull cause a percentage of these cases. Treatment is essentially surgical, but the sulpha group of drugs and penicillin are valuable wea-

pons against the staphylococci and streptococci, the main causative organisms.

Encina OR ENZINA, JUAN DE LA (c.1469 – c.1534). Spanish poet and dramatist. He was born perhaps at the village the name of which he bore, and educated at Salamanca university. His first plays were acted in 1492. When his Representaciones were performed before Ferdinand and Isabella and the court, he was secretary to the duke of Alva. In 1496 his plays, partly autos (*q.v.*) and partly secular, were published, and shortly after he went to Rome, where he became a priest and received an appointment in the pope's chapel. In 1519 he made a pilgrimage to Jerusalem, and published an account of it in 1521. He was made prior of Leon, and died at Salamanca. Founder of the secular drama, his contemporary popularity was such that six editions of his plays were produced between 1496 and 1516.

Encirclement. Term applied by German politicians to describe any alliance that tended to curb German aggressive expansion. The chancellor von Bülow was the first to raise the cry of encirclement, when in 1906 he promoted bills for the expansion of the German navy. Great Britain had striven to come to an agreement with Germany, and had turned to France and Russia only after Germany had repulsed all overtures and embarked upon a patently anti-British policy. The ties of the "encircling" alliance were really so loose that France and Russia were not sure whether Great Britain would support them at the outbreak of war. Hitler professed to see a renewed threat of encirclement in the British attempts to form an anti-aggression front in March, 1939, after the annexation of Czecho-Slovakia by Germany.

Encke, JOHANN FRANZ (1791–1865). German astronomer. Born in Hamburg, Sept. 23, 1791, he studied in Göttingen, and in 1822 became director of the Seeberg Observatory near Gotha. In 1825 he succeeded to the post of astronomer of the academy of science, and director of the Berlin Observatory, then in course of erection. In 1863 he retired into private life at Spandau, where he died, Aug. 26, 1865. Encke worked out, from the observations of the transits of Venus of 1761 and 1769, the first authentic value of the sun's parallax; determined the path of Pons' Comet; and

undertook the observation of another comet, since known by his name (*v.l.*).

Encke's Comet. On Nov. 26, 1818, Pons of Marseilles discovered an inconspicuous comet whose elements Encke calculated with the unexpected result of finding that it revolved about the sun in a period of 3½ years (1,208 days). It has been observed at over 40 returns since. The period is considerably shorter than that of any other known comet. Its outward journey takes it near the planet Jupiter, to whose family it belongs. Its unique point of interest is the steady shortening of its period, by about 2½ days in a century, which cannot be explained by the gravitational pull of any known body. It seems likely that near the sun it encounters a resisting medium which causes it to fall in towards the sun and thus to accelerate.

Enclave (Lat. *in*, in; *clavis*, key). Detached part of a country or state entirely surrounded by the territories of another. The name is used by the country owning the surrounding land, the separated tract being an exclave from the point of view of the country possessing it.

Enclosures. Word used specially for common land which is enclosed, i.e. converted by private persons to their own use. This practice began in England with the decay of the manorial system, when the lords of the manor frequently enclosed common land. From time to time there was an outcry against it, notably in Tudor times. Latimer referred scathingly to enclosures, while Somerset, acting for Edward VI, appointed a commission to inquire into the matter. The law about it during the Middle Ages was contained in the statute of Merton of 1235 which allowed the lords to enclose land, provided that they left sufficient common unenclosed to meet the rights of the commoners.

After about 1700, enclosures were made by special Acts of Parliament. The Acts distributed the land between the lord of the manor and the various persons who had rights in it. Between 1700 and 1845 there were about 4,000 of these Acts, under which about 5,000,000 acres were enclosed. In 1801 an Act ruled that the consent of three-fourths of the freeholders and copyholders of the manor was necessary before land could be enclosed. In 1845 the matter was put in the hands of commissioners whose business was to

examine suggested enclosures, and see that some part of the land was set aside for public purposes. About then the movement for the preservation of common land began. Suggested enclosures, the case of Epping Forest being the standing example, were prevented, and in 1876 an Act virtually put an end to the practice. In Scotland and Ireland the matter never attained the importance it did in England. See Commons; Manor.

Encounter Bay. Inlet of the coast of S. Australia, between Port Elliot on the N. and Jaffa Cape on the S. It is 90 m. across its entrance and is the last important indentation of the coast before the state of Victoria. Off the N.W. corner of the bay lies Kangaroo Island.

Encratites (Gr. *enkratēs*, self-controlling). Ascetic sect of the 2nd century. They taught the essential evil of matter and abstained from flesh, wine, property, and marriage. Encratite doctrines seem to have been first taught systematically by Saturninus early in the 2nd century, although the principle was combated already in I Timothy 4, and the sect became organized under the leadership of Tatian. Encratism spread widely in Asia Minor, and the apocryphal Gospel according to the Egyptians furnished some of its arguments. In the 4th century they became merged with Gnosticism and Montanism.

Encrinites. Popular name for the crinoidea (q.v.).

Encyclical (Gr. *enkyklios*, circular). Eccles. term for a letter from a Church authority, not addressed to any particular individual or community. Thus the General Epistles of S. Peter and the pronouncements of councils which were sent forth to the Church at large were thus named. The term is now used for a communication of the Pope to the bishops generally on some ecclesiastical topic. It differs from a bull, since it does not deal with any special case, but indicates general principles to guide the bishops in dealing with important questions.

Encyclopedia. Word derived from the Greek (*enkyklios*, circular, complete; *paideia*, education). The spelling of the word without the diphthong is justified on grounds of scholarship, for the very first time the Greek form was rendered into English, *via* the Latin, the writer, Sir Thomas Elyot, in *The Governour*, 1538, spelt it encyclopedia. It has been approved by Dr. Johnson, Webster and other lexicographers. The word may be translated as the whole circle of knowledge. For long it expressed this idea to scholars trained in the tra-

ditions of Rome, but it was not used as the title of a book until the 16th century, some years after the invention of printing. Before then, however, many works had been written which may be fairly described as encyclopedias, for their authors claimed to give information about all the interests of the human mind.

The first of these known encyclopedias is the *Historia Naturalis* of the elder Pliny; and the Middle Ages saw the production of *Ety-mologies* by Isidore, bishop of Seville (d. 636); and of *The Origin of Sciences* by the Arab scholar, Alfarabi (d. 950); as well as of a number of less notable ones. The most outstanding encyclopedia, however, written in Latin, was by Vincent of Beauvais (d. c. 1264). It was called *Speculum Majus* (Greater Mirror), and is divided into four main parts, dealing with science, theology, history, and morality (the last section being possibly wrongly ascribed to Vincent).

The material in these encyclopedias was arranged according to subjects, not in alphabetical order, but some time after the invention of printing the advantages of the latter arrangement became manifest. About the same time, too, it was realized that if encyclopedias were to be read they must be written, not in Latin, but in a popular language. However, before these important changes came about J. H. Alsted, in 1620, had produced a Latin work of the old kind, notable because it was the first of any size to be called an encyclopedia. The two innovations just mentioned were both introduced to the world by a Frenchman, Louis Moréri. His *Grand Dictionnaire*, 1674, was an encyclopedia in the modern sense, although, like his immediate successors, he preferred to call it a dictionary. It was very popular, and so was that of Pierre Bayle, which in 1697 appeared as an improvement on Moréri.

The first encyclopedia written in English was the *Lexicon Technicum*, 1704, of the Rev. John Harris, though as early as 1398 John Trevisa had translated a Latin work of this kind into English. Harris was followed by a much greater name in the history of encyclopedias, Ephraim Chambers, the real originator of the modern work. In 1728 Chambers produced his *Cyclopædia: or Universal Dictionary of Arts and Sciences*. A little earlier an Italian, M. V. Coronelli, had begun a more ambitious work, but it was never completed. In 1732-54 was published

Zedler's *Great Universal Lexicon* a German work ed. by J. A. Frankenstein and others, but usually known by its publisher's name.

The effects of Chambers's work were felt in France. It was translated into French, and on it was founded the most celebrated of all encyclopedias, the *Encyclopédie*, 1751-65, which, edited by Diderot and d'Alembert, counted Voltaire and Rousseau among its contributors. Neither Chambers's nor the *Encyclopédie* included biographies (Moréri's and other earlier works had done so).

The British counterpart of the *Encyclopédie* was the *Encyclopædia Britannica*. The first edition of this, ed. W. Smellie, appeared in three volumes in 1771. From it biography and history were excluded, but both appeared in the second and subsequent editions. Throughout the 19th century further editions appeared, to which leading scholars contributed. The 11th edition, by the Cambridge University Press, was published 1910-11; the 14th edition (New York) began to appear in 1929.

Meanwhile a host of other encyclopedias appeared in Great Britain and abroad. In France there was *La Grande Encyclopédie*, also that of Larousse; in Germany the *Konversations-Lexicon* of Brockhaus and that of Meyer; in the U.S.A., the *New International*; and many others. Among the English works of the kind were *The Penny Cyclopædia* of Charles Knight, 1833-43, and the one issued by the Edinburgh firm of Chambers in 1859-68, and several times revised.

At the end of the century a gigantic and novel advertising campaign carried on by *The Times* in order to sell the ninth and tenth editions of the *Britannica* had an enormous effect in popularising the work and in stimulating a demand for books of this kind. This was seen in 1905-06, when *The Amalgamated Press* put upon the market *The Harmsworth Encyclopædia*. Sold in fortnightly parts, this was an unprecedented success. Recent years have witnessed the output of a host of encyclopedias devoted to a single branch of human knowledge—theology, sport, agriculture, education, for examples; but none has ever attained such worldwide-circulation as *THE UNIVERSAL*, first serially issued 1920-22, and now after several revisions appearing in this new form.

Encyclopédistes. Name given to the contributors to the *Encyclopédie*, 1751-65, edited by Diderot and d'Alembert. They were noted writers in literature and philosophy,

including Rousseau, Grimm, Voltaire, Baron d'Holbach, and the two editors. Several of the encyclopédistes held advanced views on political and social matters, besides being sceptics with regard to Christianity, and this was reflected in much that they wrote. The influence thus exerted by the *Encyclopédie* upon the minds of the educated classes helped to ripen French public opinion in favour of the Revolution.

Endecott, JOHN (1589-1665). English colonial governor. Born at Dorchester, Dorset, he sailed



Jo. Endecott

to N. America in 1628 and became manager of the Naumkeag (now Salem) plantation. Being superseded by John Winthrop, he employed himself in fighting the Indians. In

1641 he was made deputy-governor of Massachusetts and three years later became governor, a post he held with intervals until his death at Boston, March 15, 1665.

Endemic (Gr. *endēmos*, native). Biological term applied to an organism which is found only in a particular region. It is also applied to diseases which are always more or less present in certain localities, as distinguished from epidemic diseases which may be widely prevalent at one time and completely absent at another. See Disease; Public Health.

Enderbury. For this Pacific island, see Canton and Enderbury.

Enderby Land. Desolate tract of Antarctica. It extends S. from the Antarctic Circle, in lat. 50°-55° E. It was discovered by John Biscoe in 1831, who named it after his employers, Enderby Brothers.

Endive (Lat. *intibus*). Plant of the same genus as chicory (*q.v.*).

Endocardium (Gr. *endon*, within; *kardia*, heart). Smooth membrane which lines the interior of the chambers of the heart. Inflammation of this membrane is termed endocarditis. See Heart; Rheumatic Fever.

Endocrinology (Gr. *endon*, within; *krinein*, to sift; *logos*, science). The study of the glands of internal secretion. These manufacture hormones which pass into the circulation, pervade the organism and affect various cells and tissues. The endocrine system is one of the body's two main regulating mechanisms, the other

being the nervous system. It is an example of humoral and chemical control.

Ductless glands, as they have been called, must be differentiated from other glands, particularly those which pass an external secretion down a duct to the site of its activity, *e.g.* the salivary glands; and also from the lymphatic glands which are an integral part of the lymph system and defence mechanism of the body.

Hormones (Gr. *horman*, to rouse) are physiologically active chemical substances. In most instances the action of the hormone is excitatory. An endocrine gland is usually both factory and warehouse for its hormone, as the latter is not stored elsewhere in the body for any length of time. The functions of these glands have been studied by their removal in animals, by the administration of gland extracts, and by observations on human beings in whom one or other gland is known to be over- or deficiently active. Of recent years, the active principles of a number of these hormones have been isolated and their actions studied. A considerable body of knowledge has been built up, and this has been of great value in the understanding of human endocrine abnormalities and disease.

In disease an endocrine gland may produce an excess or a deficiency of hormone. Such conditions can be recognized by characteristic symptoms. Deficiency can be corrected by hormone treatment in the form of gland extract or of active hormone. Hormones, when so administered, do not stimulate the gland which is deficient, but make up the deficiency. The process, therefore, is one of

substitution rather than stimulation.

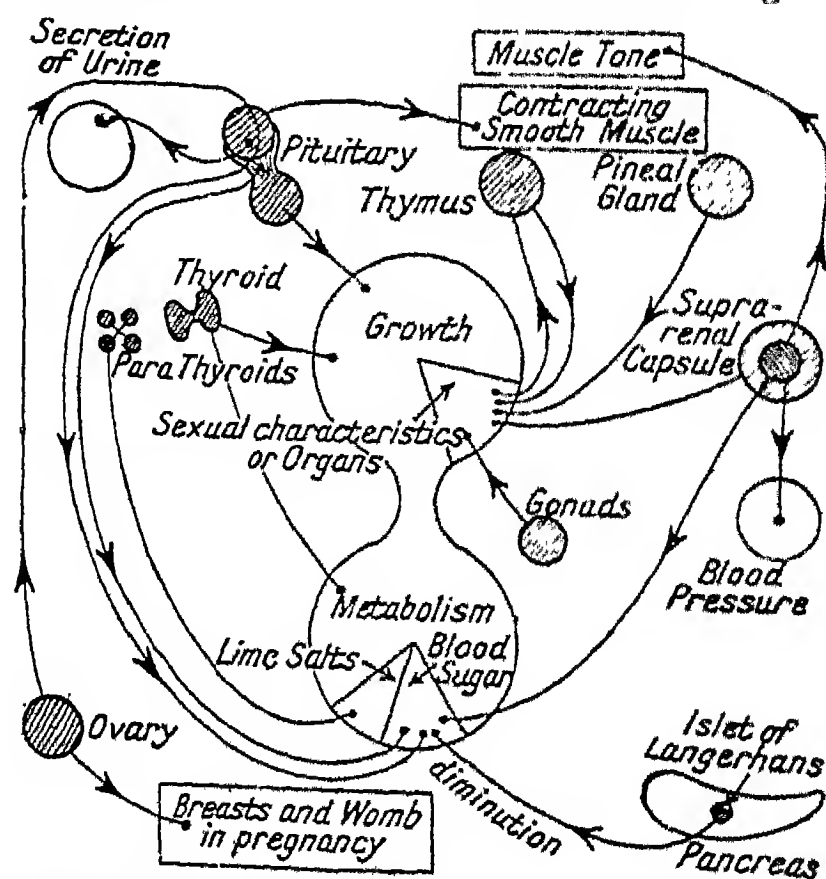
The target of the hormone is some tissue, cell or end organ which it should stimulate; but in some diseases the end organ may not be able to react to stimulation. The target or end organ for a hormone may be another endocrine gland, in which case the hormone is called trophic. The destruction of the gland which produces the trophic hormone will cause failure of the target gland. By the action and interaction of the various endocrine secretions, an elaborate system of humoral control is established. This mechanism plays an essential part in the regulation of the various bodily processes of growth, development, and metabolism.

The chief members of the endocrine series are the pituitary, thyroid, parathyroids, adrenals (or suprarenals), islets of Langerhans (in pancreas), and sex glands. With the exception of the thyroid and the male sex glands, most are located in inaccessible sites, the pituitary lying in a small bony cavity at the base of the skull, the adrenals and the pancreas on the back wall of the abdominal cavity, whilst the parathyroids lie behind the thyroid at the root of the neck.

Functionally, they can be considered in two main groups: those concerned with growth, development and reproduction on the one hand, and those concerned with metabolism on the other.

The anterior lobe of the pituitary secretes a growth hormone. In every organism there is an inherent tendency to grow, and genetic influences no doubt play the most important part in determining the stature of human

beings. On the other hand, this is influenced by the growth hormone of the pituitary, which acts by stimulating the growth cartilages of the bones. Development, and particularly development of the secondary sex characters in each sex, is due to the specific hormones of the sex glands. They are also responsible for reproduction—spermatogenesis in the male and the development of the ovum and follicle in the female. Both development and reproduction are under the control of the pituitary



Endocrinology. Diagram showing the main glands of internal secretion and their action

through its gonadotrophic hormones. Certain cells of the adrenal cortex, closely related to the sex glands, have an androgenic influence and, if present in the female, have masculinising effects.

The thyroid controls the general level of oxidative processes or basal metabolism of the body. From the raw material iodine, it produces its hormone, thyroxine, a metabolic stimulant.

Of the glands concerned with more specific metabolic processes, the pancreas, through its islet tissue, produces insulin which controls the utilisation of carbohydrate in the body and its storage in the muscles and liver. Water metabolism is controlled by the posterior pituitary which produces an anti-diuretic hormone controlling the output of water from the kidneys. The parathyroids and adrenal cortex regulate the inorganic constituents and electrolytes of the body. The parathyroids are concerned with calcium and phosphorus metabolism and determine the output of these substances from stores in the bones. Calcium and phosphorus are important in the structural stability of the skeleton and the functional stability of the nervous system. The adrenal cortex regulates sodium and chloride metabolism and controls the output of these substances from the kidneys. Sodium and chloride are essential to the maintenance of water balance in the body. With deficiency of cortical hormone, there is a leak of sodium and chloride from the kidneys.

The adrenal medulla has an emergency function and produces adrenalin. This accelerates the heart rate and amplifies heart action. In other ways it mobilises energy and prepares the organism for action.

The pituitary has been called the master gland owing to its central position and trophic hormones. In addition to the functions mentioned, it controls the thyroid, adrenals, probably pancreas, and possibly other glands. It is closely connected at the base of the brain with nerve centres integrated with higher levels of the nervous system. The two main controlling mechanisms of the body—nervous and endocrine—thus function together.

H. Gardiner Hill

Endoderm. The innermost of the three layers into which the walls of a gastrula can ideally be divided. It forms the gut and its derivatives. See Gastrula.

Endogamy (Gr. *endon*, within; *gamos*, marriage). Primitive institution binding a man to marry within his own society, or subdivision of it, only. Endogamy appears to be most developed where distinctions of social class are of supreme importance. The ladder of Hindu castes, each of which is endogamous, is the best known example. An approach to the condition was marked in the European aristocracy. Exogamy and endogamy frequently coexist in different units of the same society. Exogamous clans or gotras make up each endogamous Hindu caste.

Endophyte (Gr. *endon*, within; *phyton*, plant). Name given to a plant which lives in other plants. See Fungus; Parasite.

Endoplasm. The inner, more granular, part of the cytoplasm of such an animal as amoeba. It is probably normally in the physical condition of a sol, distinguished from the ectoplasm which, covering the surface, is probably normally a gel. It seems likely that the one can become the other by thixotropic change.

Endor. Village of Palestine, now known as Endur, about 6 m. S.E. of Nazareth and close to Mt. Tabor. It was the home of the witch whom Saul consulted.

Endorsement OR **INDORSEMENT** (Lat. *dorsum*, back). Something written on the back of a document. Its most familiar form is that of the signature which must be put upon the back of a cheque, bill of exchange, etc., when it is passed from one person to another. The endorsement must correspond with the name on the front or it will be irregular. By endorsing a cheque or bill the owner transfers his rights to another.

Endosperm (Gr. *endon*, within; *sperma*, seed). Tissue found in the seeds of Gymnosperms and many flowering plants, and in spores of selaginella. In the pines (Gymnosperms) the endosperm is formed before the embryo comes into existence; in the flowering plants proper (Angiosperms) embryo and endosperm are formed simultaneously. If a longitudinal section is made of a ripe pine-seed, for example, the embryo will be found to occupy a central cavity, surrounded by a mass of cellular tissue. This is the endosperm, which is gradually absorbed as food by the developing embryo or seedling to tide over the critical period in which it is establishing its roots and expanding its first leaves.

Endothermic AND **EXOTHERMIC** COMPOUNDS AND REACTIONS.

Terms used in chemistry to distinguish between compounds which are formed from their elements with the absorption of heat (endothermic) and compounds formed from their elements with the evolution of heat (exothermic). Carbon disulphide is an endothermic compound; carbon dioxide an exothermic compound. An endothermic reaction is a chemical change that requires heat in order to take place; an exothermic reaction is one that evolves heat. If sulphur trioxide is added to water, sulphuric acid is formed with evolution of heat; if sulphuric acid is mixed with water, a hydrate of sulphuric acid is formed with evolution of heat: both these are exothermic reactions. The endothermic compounds are in general less stable than the exothermic ones. The reduction of iron in blast furnace is an exothermic reaction, heat being evolved in the process. The formation of nitroglycerine is an endothermic process and nitroglycerine an endothermic compound.

Endowment (Lat. *dos*, a dowry or gift). Gift of money or land to which the idea of permanence is attached. Endowments indicate the vast amounts that have been given or bequeathed for the support of churches, colleges, schools, hospitals, and charitable institutions of all kinds. In the U.K. ancient endowments are under the general control of the state, acting through bodies appointed to supervise them. Such are the Church Commission that controls the endowments of the Church of England, and the Charity Commission that controls funds left for almshouses, hospitals, and the like. Endowed schools are under the supervision of the Minister of Education. The process of time frequently makes trusts governing old endowments quite out of keeping with the age, and so from time to time parliament has dealt with the matter. Thus the Endowed Schools Acts of 1869–89 removed many abuses and gave these trusts a more modern spirit.

Endurance. In mechanics, the quality of a material which allows it to sustain the stresses to which it may be subjected. In fatigue testing, to which the term particularly relates, the endurance of a specimen is the number of repetitions of the applied stress cycle which have been sustained at the moment of fracture. The value of the stress range which is then just insufficient to cause fracture is known as the endurance limit.

This endurance limit, or fatigue limit, is often expressed as a ratio of the ultimate strength of the material under test, this ratio being known as the endurance ratio.

Endymion. In Greek mythology, a youthful shepherd of great beauty. Of him the moon-goddess Selēnē became enamoured, as he lay asleep on Mt. Latmos in Caria. Selēnē caused him to sleep for ever, so that she might be able to visit him and kiss him every night without his knowing it.

Endymion. Poetic romance in four books of rhymed couplets by John Keats, first published in 1818. A rhapsodical rendering of the classic story of the beautiful youth who inspired love in Cynthia, it is full of poetic riches, both of language and of thought. Its opening line "A thing of beauty is a joy for ever," has become one of the most familiar of quotations.

Endymion. Novel by Benjamin Disraeli, earl of Beaconsfield, first published in 1880. It is a presentation of political and social life in England during the middle of the 19th century, opening with the death of Canning and passing lightly through the Reform period. Though the story is slight, the characterisation is brilliant; and the narrative has much of the sparkle and less of the ornateness of Disraeli's earlier novels. Many of the characters were but thinly disguised delineations of actual people of the period, Lord Palmerston, Lady Jersey, and others.

Enema (Gr., injection). Fluid injected into the rectum. Enemata are used for washing out the rectum to relieve constipation, when they usually consist of a pint or more of soap and water, or of oil to soften the faecal mass. Substances such as quassia may be thus introduced into the bowel for the destruction of thread worms. Normal saline may be run in with a view to its absorption in a dehydrated patient who cannot swallow fluid, and in such cases nutrient substances such as raw egg, glucose, or peptonised milk may also be used.

Enemy (Lat. *inimicus*). Generally one who is antagonistic or hostile. In time of war, however, it has a special and narrower meaning referring to the state and its subjects with which another state is at war. By the laws of war these are on a very different footing from friends or neutrals. Their persons and property can be seized, and freedom of movement denied to such of them as are on the soil

of the country with which they are at war. They become enemy aliens, sharply distinguished from friendly or neutral aliens.

TRADING WITH THE ENEMY. At least since the Napoleonic wars it has been recognized as vitally



Endymion. Greek statue of the sleeping shepherd in the British Museum

important to prevent the enemy obtaining goods, credit, and other resources which will help him in carrying on war. Before 1914 trading with the enemy was forbidden and made a criminal offence by English common law. In most other branches of the law, the test whether or not a person is an enemy is his nationality; but this test would not be satisfactory in connexion with trading with the enemy, as the objects of the law would not be achieved if persons in England were forbidden to trade with enemy nationals but free to trade with persons resident in enemy territory who were of neutral or even British nationality. In this connexion, therefore, enemy means any person of whatever nationality residing in any territory occupied by the enemy. It was held by the house of lords in 1943 that a Dutch trader in Holland during the German occupation was an enemy, even though he might be bitterly opposed to the Germans and was trading merely to make a living.

During both Great Wars, legislation was passed under which any person—whether of enemy or of neutral nationality or even a British subject—might be deemed by order in council to be an enemy. The names of such persons were placed on a black list. Common law rules, found insufficient, were also widely supplemented. The Trading with the Enemy Act, 1939, as amended by Defence Regulations, gave extensive administrative powers to the Board of Trade and the Treasury. Where any business in Great Britain was suspected of trading with the enemy it could be inspected and its affairs supervised by the Board of Trade; any business carried on by or under the direction of an enemy or

enemy national could be controlled and wound up by the Board. Custodians of enemy property were appointed with the right to recover all sums due to an enemy. The Act of 1939 was not passed as a temporary war-time measure. The maximum penalty for trading with the enemy is seven years' penal servitude.

Energiser. Material used in the carburising process to accelerate the rate of adsorption of carbon by the steel being carburised. Energisers usually consist of metallic carbonates, chiefly those of sodium and barium, added to the carburising compound to the extent of 5 to 20 p.c. by weight. They act by decomposing to give off carbon dioxide gas, which reacts with the carbonaceous matter in the carburising compound to form carbon monoxide gas. Some regard these carbonates as reacting with carbon monoxide gas and producing by catalytic decomposition a reactive form of carbon, which is absorbed rapidly by the steel. Accelerators are also employed in other processes, such as cyaniding, chromium deposition and vitreous enamelling.

Energy. Term in physics often defined as capacity to do work (*q.v.*). It can be thought of either as accumulated work, or as "what is used up when work is done." In mechanics energy is measured as the product of the force acting and the distance (in the direction of the force) through which it acts. The units are the units of work. Thus if a vertical force raises one pound weight through one foot the energy expended (and also the work done) is one foot-pound. In the C.G.S. system the unit is the erg, equal to one dyne acting through one cm; in the F.P.S. system it is the foot-poundal. Since the erg is very small, a practical unit, the joule, is used, equal to 10^7 erg.

Mechanical energy can take two forms: (1) kinetic energy, possessed by a moving body because of its motion (it is the kinetic energy of a running billiard ball which enables it to knock another one on): this is equal to $\frac{1}{2}mv^2$, where m is its mass and v its velocity; (2) potential energy possessed by a body because of its position (it is the potential energy of a clock weight which is eventually expended in driving the clock): this is equal to the work which would be done in moving the body to its actual position from a natural position

of rest. If (unlike the clock weight) it is allowed to relapse freely to its position of rest, it will progressively lose potential energy and acquire a corresponding amount of kinetic energy.

It took many years for the important distinction between force and energy to be realized, and to some extent the progress of physics was held up until Kelvin suggested and defined the term in 1851. Meanwhile, it was gradually established that quantities such as heat (as distinct from temperature), electric current, and radiation are also forms of energy, and that energy may be stored up in chemical compounds and released or absorbed by chemical reactions. Between 1845 and 1850 Joule conducted a series of experiments, in which he heated water by stirring it with paddles driven by weights falling through a known distance, and found that it always took 772 foot-pound of energy to raise 1 pound of water through 1° F. This gives for the relation known as Joule's equivalent, or the mechanical equivalent of heat, $J = 4.153$ joule per calorie. The modern figure, from more accurate electrical experiments, is about 4.1855 abs. joule per 15° cal. From the discovery of this fixed relation the whole science of thermodynamics (*q.v.*) developed and the principle of conservation of energy became firmly established.

Joule converted mechanical energy to heat. A steam engine converts chemical energy in the coal to heat, and the heat in turn to mechanical energy. In most steam engines only about 15 per cent of the chemical energy is recovered as mechanical energy; the rest is dissipated in furnace heat that does not reach the water, in steam pressure not applied to the pistons (e.g. escaping in the blast), in overcoming friction, etc. An electric generator may convert potential energy in high lying water into electric current, which may then be used to produce heat, light, or mechanical energy. Heat, however, which is the kinetic energy of the rapidly moving molecules, can be converted into mechanical or electrical energy only if there is a difference of temperature; otherwise there is no way of harnessing the individual molecules. Hence Kelvin's distinction between "available" and "diffuse" energy, and the modern conception of entropy (*q.v.*).

Einstein's Special Theory of Relativity suggested that mass

might be convertible into energy on the basis of the relation $E = mc^2$, where E is the energy, m the mass, and c the velocity of light. This has since been found to take place in atomic disintegrations, where the mass of the original nucleus is greater (by about 8 parts in 10,000) than the sum of the masses of the nuclei formed. The disappearance of 1 gm. of mass produces 8.99×10^{20} erg of energy. In atomic physics, however, it is convenient to use another unit, the electron-volt (e.V.) equal to the energy acquired by one electron accelerated through one volt:

$$1 \text{ e.V.} = 1.601 \times 10^{-12} \text{ erg;}$$

$$1 \text{ M.e.V.} = 10^6 \text{ e.V.}$$

Enfantin, BARTHÉLEMY PROSPER (1796–1864). French Socialist. Born in Paris, Feb. 8, 1796, he was educated at the École Polytechnique. In 1825 he met Saint-Simon and adopted his teaching, which he and Bazard disseminated during the next five years. In 1832 he was sentenced to a year's imprisonment for his public advocacy of free love. After a journey to Egypt he was appointed postmaster of Lyons, and in 1845 became a director of the Paris-Lyons rly. He died in Paris, Aug. 31, 1864. Enfantin's principal works are *Doctrine Saint-Simonienne*, with Amand Bazard, 1830; *Économie Politique*, 1831.

Enfield. Borough of Middlesex county, England. It is 10½ m. N. of London by rly.: the Piccadilly line also serves its W. part, although the station (Oakwood) lies just beyond the boundary. The New River intersects the town. The chief building is the parish church of S. Andrew, parts of which date from the 12th century, and which contains the beautiful 15th century Tiptoft brass. The palace, built by Edward VI for his sister Elizabeth, has been demolished, but the panelling, a chimney piece, and a ceiling were transferred to Little Park. The grammar school was founded in 1557. The King and Tinker inn is associated with James I. Near the Ridgeway and the residential W. portions of the dist. a large area forms part of London's green belt. The E. of the district is populous, with an electrical industry. At Enfield Lock is the Royal Small Arms Factory. With Potter's Bar, Enfield forms two bor. constituencies. Enfield is mentioned in Domesday Book as Enefelde. Edward VI and Elizabeth I lived here, and Enfield Chase, disforested in 1777, was a favourite hunting ground of

James I. It has associations with Keats, Marryat, Isaac D'Israeli, and Lamb. Pop. (1951) 110,465.

Enfield Rifle. Weapon issued to the British army in 1852 to replace the Minie rifle, and used in the Crimean War. The original Enfield rifle was a muzzle-loader, but in 1866 it was converted to breech-loading. The barrel was 29 ins. long, the rifling consisting of five grooves with a twist of 1 in 48; it fired a hollow-based bullet. The rifle had a range of 1,000 yds. It was replaced in 1888 by the Lee Metford. See Rifle.

Enfilade (Fr. *enfiler*, to thread). Military expression which indicates fire along the direction of the enemy's line or trenches, i.e. from a flank. It robs the defenders of an entrenched position of their cover unless the line is well traversed; and few weapons in the line can be brought to bear to counter it. If a unit in action has to change its front it runs grave risks of coming under enfilade fire at once. The advantage of gaining a position on the enemy's flank when attacking is enhanced by the opportunity it gives of subjecting him to enfilade fire. In defensive positions machine-gun posts are sited on the flanks to bring enfilade fire upon troops making a frontal assault. See Artillery; Tactics.

Enfleurage. Extraction at ordinary temperatures by a non-volatile solvent of the perfume of delicate flowers. The solvents generally used are the finest lard, olive oil, and sometimes high quality mineral oils. The flowers are added to the melted fat or warmed oil, and the mass is stirred to assist extraction. In cold enfleurage fat is spread on both sides of a sheet of glass surrounded by a wooden frame (chassis), the flowers being spread on the upper surface. Charged frames are built up so that a chamber is formed of which the top and bottom faces are covered with fat. From the products of enfleurage perfume materials are prepared by extraction with alcohol. The process is carried out at Grasse, the centre of the French perfumery industry.

Engadine. Upper portion of the Inn valley, Switzerland, in the canton of Grisons. Divided into the Upper and Lower Engadine, it stretches 60 m. between two chains of the Rhaetian Alps, and is 1 m. to 1½ m. broad. From Martinsbruck, on the border of Tirol, it runs S.W. up to the Maloja Pass, traversed by a good carriage road, and there are rlys. to St. Moritz and Pontresina. The



Engadine. Village of Samaden in the Upper Engadine, with the Piz Rosatsch on the left

Upper Engadine has a series of small lakes and is more frequented than the Lower Engadine, which, however, has the attraction of its mineral springs at Schuls. The sides of the surrounding mts. are covered with pine forests to the height of 7,200 ft. The strong, bracing air of the valley renders it an extremely popular health resort. The inhabitants, mostly Protestants, still speak Latin or Romansch, a speech akin to Italian and French.

Engagement. Word meaning originally to bind by a gage or pledge, and used in several senses. It means an undertaking to marry and also a more general kind of pledge—e.g. an engagement to pay a debt or to meet a friend. It is also used as a synonym for a battle; this comes from an old meaning of engage, that of joining or fastening, as when, in architecture, two beams engage or interlock.

Historically, the Engagement is the agreement signed, Dec. 26, 1647, by Charles I and the Scots represented by the marquess of Hamilton. Charles was a prisoner at Carisbrooke, and he agreed, in return for Scottish assistance in restoring him to the throne, to establish Presbyterianism in England. See Charles I; Civil War.

Engelberg. Village of Switzerland, in the canton of Unterwalden. It stands at the N. foot of the Titlis, 14 m. by electric rly. S. of Lucerne. It is a favourite summer and winter tourist resort, with numerous hotels and boarding-houses and an English church. The abbey church is interesting; and the library has 20,000 vols. and 210 MSS. The large Benedictine abbey, founded 1120, was rebuilt in 1729; it has a school and its farm is noted for its cheeses. Engelberg owns common lands, which help to maintain its poor.

Engels, FRIEDRICH (1820–95). German Socialist writer. Born at Barmen, Prussia, Nov. 28, 1820,

he was the son of a cotton spinner. He visited England in 1842 and lived in Manchester from 1850 and in London from 1870 until his death, Aug. 5, 1895. He was corresponding secretary of the International Working Men's Association, or the International, for



Friedrich Engels, German Socialist

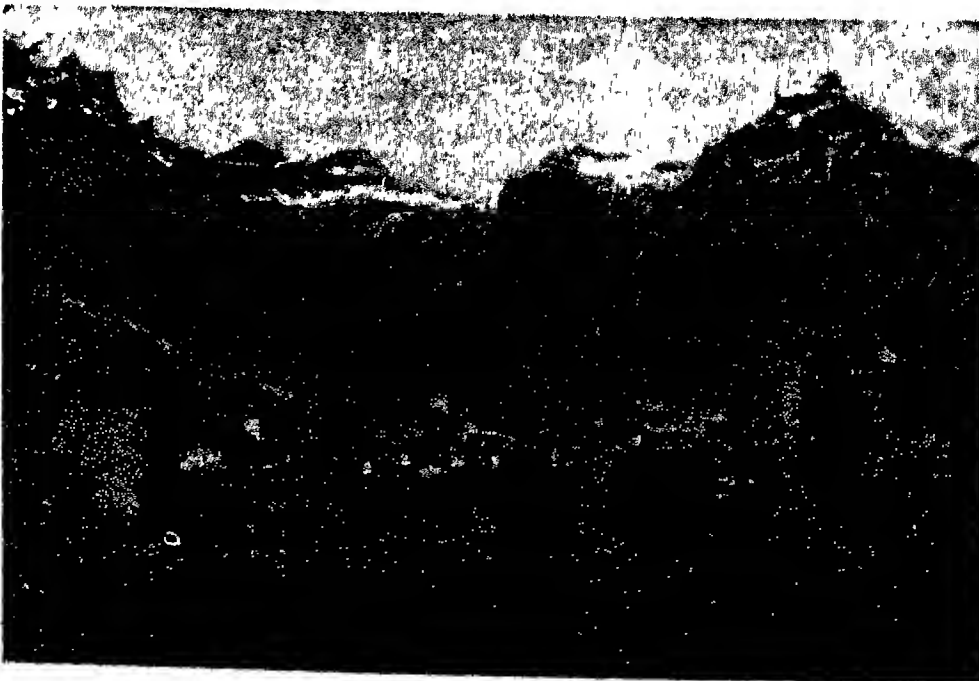
Italy, Spain, and Belgium, an organization formed in 1864 with the object of ending war and subordinating capital to labour. Engels was the friend of its moving spirit, Karl Marx, with whom he collaborated in the communist manifesto of 1847. Engels' works include *The Condition of the Working Classes in England*, 1845, Eng. trans. repr. 1920; and *The Origin of the Family, Private Property and The State*, 1884. Consult *Life*, G. Mayer, Eng. trans. R. H. S. Crossman, 1936.

Enghien, LOUIS ANTOINE HENRI DE BOURBON CONDÉ, DUC D' (1772–1804). French nobleman. Born at Chantilly, Aug. 2, 1772, he entered the army in 1788. In 1792 he held a command in the royalist army

raised by his grandfather, the prince of Condé, fighting against the republicans until the peace of Lunéville, 1801. In 1804 he was falsely accused of having taken part in the Cadoudal-Pichegru conspiracy against Napoleon, was seized in the neutral territory of Baden, hurried to Paris and, after a mock court-martial, was shot at Vincennes, March 21, 1804. The murder of the duc d'Enghien, a crime from which Napoleon vainly tried to exculpate himself in St. Helena, occasioned the famous saying of Fouché: "It was worse than a crime; it was a blunder."

Engine (Lat. *ingenium*, skill). Appliance for converting energy in the form of heat, or less usually a head of water, into work. In general the heat is first produced by the combustion of some form of hydrocarbon fuel (coal, gas, petrol, or oil) and this is converted into pressure energy either externally to the engine (as in steam engines) or internally (as in gas, petrol, and oil engines). Using the name in its modern sense, an engine has to repeat the same cycle of operations at regular intervals (as with reciprocating engines) or to apply a continuous torque to a rotating shaft by means of jets of fluid (as with steam turbines or gas turbines).

The earliest engines used steam as a working agent. Hero of Alexandria (c. 5 B.C.) used the reaction of jets of steam issuing from a series of nozzles to produce rotation of a globe carrying the nozzles. Branca (1619) used the momentum of a jet issuing from a stationary nozzle and impinging on vanes fixed to the circumference of a rotating wheel. Savery (1698) utilised the pressure of steam acting on the surface of the water to pump water a height of 100 ft. The first practicable reciprocating engine for pumping water from mines was Newcomen's (1712); steam on one side of a piston was condensed, forming a partial vacuum and allowing atmospheric pressure on the other side to overcome the external resistance. Watt (1765) improved the economy of the engine by adding



Engelberg. The Swiss village at the foot of the Titlis Alp

a separate condenser to it and later (1770) utilised the pressure of the steam. Invention of the crank (1781) enabled reciprocating motion to be changed into rotary motion. Trevithick (1800) and Stephenson (1814) applied the engine to locomotives, including slide valves and reversing gear. Symington (1802) constructed the first marine engine. Further developments in steam-engines, including compound expansion (1845), were applications of scientific methods, precision machines, and new materials, until Parsons (1890) invented the steam turbine.

About 1670 Huygens experimented with gunpowder in a cylinder fitted with a piston. In 1820 Farish designed and constructed a small engine to work with gunpowder, but no successful outcome is recorded. Cecil, in 1820, constructed what appears to be the first working gas-engine, using an explosive mixture of hydrogen and air. The free piston engine of Otto and Langen followed, and in 1860 the Lenoir engine, using a mixture of gas and air without compression. De Rochas stated the procedure to be followed by an economical engine, and Otto constructed engines working on his four-stroke cycle. In 1878 Clerk made the first engine working on the two-stroke cycle. Daimler was the earliest to experiment with fast-running petrol engines and in 1883 a De Dion car was fitted with a petrol engine running at 800 r.p.m.

Priestman's, of Hull, were the first firm to use paraffin as a fuel for engines (1885). Diesel published *The Rational Heat Motor* in 1893, and the first successful Diesel engine was built in 1897. Lastly, the combustion gas turbine has made rapid strides in efficiency, and its future commercial operation in large units is assured. See Diesel Engine; Gas Engine; Gas Turbine; Internal Combustion Engine; Locomotive; Oil Engine; Steam Engine; Steam Turbine; Two-stroke Cycle.

A. T. J. Kersey

Engineer Admiral. Highest commissioned rank in the engineering branch of the Royal Navy. An engineer admiral's rank is indicated by one broad gold band below three narrow gold stripes, the band and stripes being separated by stripes of purple cloth. Large naval dockyards are generally under an engineer admiral, who is responsible for the running of workshops and repair of warships.

ENGINEERING: A GENERAL SURVEY

A. H. Gibson, D.Sc., formerly Prof. of Engineering, Manchester Univ.

This article states the history of and relationship between military, civil, mechanical, and electrical engineering, and outlines an engineer's duties and studies. See also articles on the various branches of engineering activity, e.g. Bridge, Dam, Electronics, Engine, Road, etc.; and biographies of famous engineers

Historically considered, engineering is the earliest of the arts, emerging in the dawn of civilization when the first tool was made by man. Little is known as to the earliest development of engineering knowledge. It must have been of a comparatively high order to render possible the construction of the monumental works of Egypt and the East, and the priests of many of the ancient religions probably had an expert knowledge of some branches of mechanics. The aqueducts and bridges built by the Romans, and the remains of metal pumps of the Roman period, show that the principles of civil, mechanical, and hydraulic engineering were well understood before the Christian era.

In England the term engineer as defining an occupation appears to have dated from the 13th century. In the wardrobe account of Edward I (1300) occurs a statement of sums paid to engineers for military artificer's work. In 1344 the army records note the number of engineers on the strength of the ordnance. Their duty was not only to direct warlike engines and weapons, a duty afterwards delegated to the artillery, but also to undertake the design and construction of fortifications, roads, bridges, machinery, and other works of military service.

Beginnings of Civil Engineering

About the 12th century public attention in France became directed to the internal communications of the country, and an association was formed under the name of the Frères Pontiers with the main object of building bridges. The association was extended throughout Europe, and it built the first stone London Bridge, perhaps the earliest example of a definite body devoting itself to civil engineering works.

The birth of civil engineering in its modern sense was at the beginning of the 17th century. The rivers of N. Italy, which had been in use for navigation and regulated for irrigation from early times, appear to have relapsed into a bad state of order, with the result that many disastrous inundations took place. The most learned scientific men of the day were called into consultation,

which led to studies and experiments. A class of practitioners was called into existence capable of dealing with hydraulic works and with their necessary mechanical arrangements, and the scope of their work was gradually extended to cover also the design and construction of roads, bridges, docks, workshops, and machinery in general. As this class of work was analogous to that allotted to engineers of the military service, the new profession adopted the title of engineer, prefixing the word civil to distinguish its members from their military brethren.

Probably the best definition is that used by the Institution of Civil Engineers, which defines engineering as "the art whereby the great sources of power in nature are converted, adapted, and applied to the use and convenience of man"—which covers all activities of the engineer, whether civil, mechanical, or electrical.

Mechanical and Electrical Branches

The development of the steam engine led to an enormous and rapid expansion in the branch of civil engineering devoted to the design and construction of motive-power machinery and mechanical appliances, and to the development of manufacturing processes. From this period dates the professional term mechanical engineer. Later, the development of the electric dynamo, and of all the electrical appliances and accessories to electric power and lighting, rendered this sub-branch of mechanical engineering sufficiently important to justify the professional title of electrical engineer.

With further intensive specialisation, aero engineering, agricultural engineering, chemical engineering, and metallurgical engineering are now to all intents and purposes separate professions. In general the term civil engineering is confined to the design and construction of such works as roads, bridges, rlys., docks, harbours, canals, dams, and coast defences, all of which are essentially of a stationary character.

The scientific study of engineering principles is of comparatively recent growth. The first engineering school attached to any university in the United Kingdom was

founded at Glasgow. This was quickly followed by similar schools at other universities, and a training in the profession can now be obtained at any university or technical institute in the kingdom. In mechanical engineering, great developments have taken place in the branch of internal-combustion engineering, using petrol and heavy oils; in steam and internal-combustion turbines; and more recently in jet propulsion for aeroplanes. For many purposes the turbine has supplanted the steam engine, on the use of which the industrial revolution was based.

Developments in the use of atomic energy indicate that engineers may be able to utilise this in prime movers, probably mainly for providing the energy for steam raising in comparatively large plants for generating electricity.

In electrical engineering the development of high-tension overhead transmission lines has rendered it possible to harness large waterfalls and other sources of water-power remote from any industrial centre, and to transmit this energy, developed by the use of hydraulic turbines coupled to electric generators, to be used at the most convenient site. In the U.S.A. and Canada such transmission lines, some of them exceeding 200 m. in length, have long been in use. In view of the success of these systems, of the comparative cheapness with which water-power can be developed, and of the rising cost of coal, great interest is being taken in the harnessing of water-power in most countries of the civilized world, and such hydro-electric development has provided an interesting chapter of engineering history. The increase in the cost of fuel is likely to accelerate the development of hydraulic resources, and has rendered possible the development of tidal power at such sites as the Severn estuary.

The possibility of obtaining large blocks of power at the low prices obtaining in many hydro-electric developments has given a great stimulus to electro-chemical and electro-metallurgical processes. Many processes, partly chemical and partly engineering, *e.g.* the manufacture of aluminium and the production of electrolytic copper, are commercially possible only where electrical energy at a cheap rate is available. On the European continent much electrical energy derived from water-power is also used for the production of artificial fertilisers from

the nitrogen of the air. In view of the rapid depletion of the world's natural nitrate deposits, and the diminution in fertility of most of the great wheat and cotton growing areas, the production of such artificial fertilisers must become a question of world-wide importance. Among other modern developments in electrical engineering are lighting by the incandescent lamp; traction as applied to tramways and suburban and main rlys.; wireless telegraphy and telephony; and radar.

The developments in civil engineering have been probably less marked than in any other branch. Methods of construction have been in general improved and rendered more efficient by the extended use of labour-saving machinery; the design of masonry structures and of steel bridges has been put on a more satisfactory footing; and the necessity for road surfaces capable of withstanding the wear and tear of high-speed motor traffic has led to advances in the art of road construction. The introduction of ferro-concrete, with its combination of steel bars embedded in concrete to increase its tensile strength, has given rise to a distinctive type of construction, which for bridges, retaining walls, and large buildings often offers many advantages in cheapness of construction and maintenance over the older type of masonry or steel structure.

The material prosperity of mankind depends on the work of the engineer. Its means of communication, transport, and locomotion, whether by land, water, or air; its energy supplies; its water supplies and drainage, are dependent on his activities. Indeed, civilization in the modern sense and engineering may be said to be synonymous. While the enormous range of the subject renders it imperative for the engineer to specialise in one branch of his profession, the training of the young engineer should be on as broad lines as possible, and the wider his grasp of the outlines of all its branches, the better are his prospects of ultimate success. The professional training should include a three years' course in the engineering school of some university or technical institute. The first two years of this course are common to all branches of engineering, and usually include the study of chemistry, physics, and mathematics, and the elementary study of civil and mechanical engineering construction,

strength of materials, heat engines, hydraulics, mechanics, along with design work in the drawing-office.

The third year is usually devoted to a more advanced treatment of the subjects relating to some special branch of engineering, and this theoretical training should be followed by a course of practical work in the appropriate workshops or engineering office. It is in some respects an advantage for the practical training to be taken, whether wholly or in part, before the university course, while in some universities provision is made for a "sandwich" course, in which the engineering student takes his workshop training during the summer of each year and pursues his theoretical studies during the winter.

Engineer Officer. Commissioned officer of the Royal Navy. Engineers were first appointed to warships in 1838, when the Royal Navy was experimenting with steam propulsion. The first naval engineers ranked only as warrant officers, and engineers were not commissioned until 1848. In 1878 the Royal Naval Engineering College was established at Keyham Dockyard, Devonport. Since 1903 engineer officers have been trained as executive officers and are competent to take executive duties and rise to the highest ranks. They enter the service as midshipmen and undergo four years' training, most of their time being spent in the dockyard workshops and fitting-out basins at Keyham. If 70 p.c. of maximum marks are obtained at the final examination, engineer midshipmen go to Portsmouth for six months in the torpedo school; they are then commissioned as sub-lieutenants (engineers). Technical specialists, they are responsible for the efficient running of main and subsidiary machinery in warships and the control of the engineering workshops and repairs on board. An engineer officer is distinguished by wearing stripes of purple cloth between the bands of gold lace denoting his rank.

Engineers, Society of. British learned society. Established in 1854, it was incorporated in 1910, when it was amalgamated with the Civil and Mechanical Engineers' Society, dating from 1859. It exists to further the interests of the engineering profession as a whole. The society consists of hon. fellows, fellows, members, associate members, associates, graduates, and students. The h.q. is at 17, Victoria Street, Westminster, S.W.1.



Fuller topographical details of England and Wales will be found in the larger scale maps given under the names of the various counties

To face page 3069

ENGLAND: ITS TOPOGRAPHY, HISTORY, ETC.

A. D. INNES, Author of *A History of England: and Others*

A description of England, from the topographical, the geological, and the climatic points of view, is followed by some account of its industries and communications. Then come sections dealing with its government and its history, the latter being taken down to 1707, from which date it is continued under the heading of United Kingdom. In addition, some thousands of articles describe the counties and towns, rivers and mountains of England, deal with the lives of kings and statesmen, with wars, battles, and political and social movements. Government, local and national, is described in detail under Borough; County; Parish; Parliament, etc.

England, (A. S. Engla land, the land of the Angles), covers the larger and southern part of the island of Great Britain, excepting only that western part of it known as Wales. It is bounded by Scotland on the N. and Wales on part of the W.; elsewhere its borders are the North Sea on the E., the English Channel on the S., and the Atlantic Ocean and the Irish Sea on the W.

The area of England is 50,874 sq. m., being about five-ninths that of Great Britain. It measures 430 m. in extreme length, from the Lizard to Berwick-on-Tweed, and 370 m. in extreme width, from Land's End to Lowestoft. The coast, especially on the W., is broken with numerous openings, making a total length of 1,800 m. The W. coast is high and rocky, bold cliffs and buttresses of hard rock standing out to sea. On it are three large openings — Solway Firth, Morecambe Bay, and the Bristol Channel, as well as the mouths of the Ribble, the Mersey, and the Dee, which, however, is Welsh on one side. The chief headlands are St. Bees Head, Hartland Point, and Land's End.

The S. coast combines the peculiarities of both the E. and W. coasts, the two sections being divided by the Isle of Wight. East of this is a coast-line with a low, clay shore, broken here and there by chalk cliffs; W. of it the coast is high and bold. Several good harbours include Portsmouth Harbour, Southampton Water, Weymouth Bay, Tor Bay, Plymouth Sound, Falmouth Harbour, and Mount's Bay. The chief headlands are the Lizard, Start Point, Portland Bill, St. Alban's Head, Selsey Bill, Beachy Head, Dungeness, and the S. Foreland.

The E. coast is regular in outline, broken only by the estuaries of rivers. In places it is high and rocky, but much of it is low and sandy, and along parts of it the sea is encroaching. The principal river mouths are those of the Tyne, the Tees, and the Humber, the Great Ouse and the Thames. The chief headlands are Flamborough Head, Spurn Head, Lowestoft Ness, the Naze, and the North Foreland. The N. boundary is formed by the

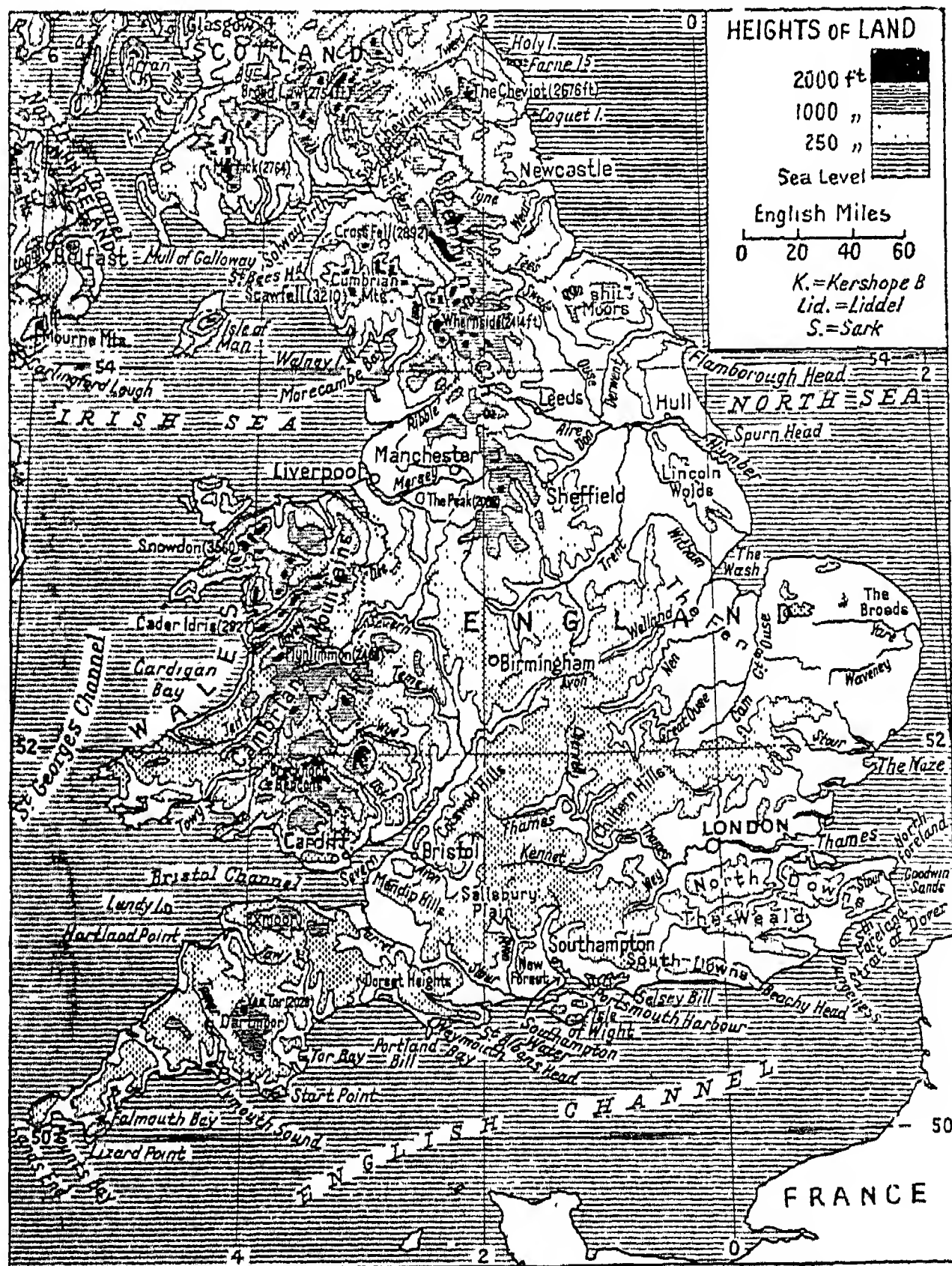
course of the Tweed, the line of the Cheviots, and Kershope Burn, Liddel Water, the Esk, and the Sark, falling into the Solway. This border is a little under 100 m. in length.

There are few important islands off the coast of England. The Isle of Man, mid-way between the Cumberland coast and Northern Ireland, is not strictly part of England, having its own laws and government. Off Northumberland are the Farne Islands, Lindisfarne or Holy Island, and Coquet Island. Foulness Island is off Essex. Off the W. coast are Walney Island, opposite Barrow, and Lundy Island in the Bristol Channel. Off Land's End is a group, the Scilly Islands.

The Isle of Wight is largest of all and ranks as part of Hampshire.

England is divided into 41 counties, including London, which was formed in 1888 out of parts of Middlesex, Surrey, and Kent. Some counties are subdivided for administrative purposes, while in the three ridings Yorkshire has a more historic division. The counties, with their acreage, which includes the sheets of water therein, and their population according to the census of 1951, are shown in the table in page 3070. The number beside each county indicates its relative position as regards size and population.

The census of April 27, 1931, showed the population of England



England. Physical map, showing the main mountain ranges of England and Wales, the principal rivers, and the coastal features

to be 37,794,003; 18,061,643 males and 19,732,360 females. Figures for the previous decennial censuses were: 1921, 35,681,019; 1911, 34,045,290; 1901, 30,813,043. No census was taken during the Second Great War, but on the last day of June each year an estimate of civilian population was made. At the post-war census of 1951 the pop. was 41,572,585 (including Monmouthshire). The losses of war had therefore been more than made good by an in-

From the recently laid-down alluvial deposits of the Wash to the oldest rocks present in Cumberland and Cornwall the geological series is almost complete. England has been gradually built up by successive additions to the older Cumbrian and Cornish lands as the marine deposits of the several geological ages have permanently emerged from below the sea.

The old western lands occur in three portions. The Lake District is the oldest, with Ordovician and

Between the rivers Tweed and Trent the carboniferous rocks form a chain of uplands which makes a definite water-parting between the rivers of the North and the Irish Seas. Flanking the Pennines are the coalmeasures, which lie in pairs. In the N. the Cumberland and Durham and Northumberland coalfields reach the coast; S. of the range the Lancashire and N. Staffordshire coalfields on the W., and the York, Derby, and Nottingham coalfield on the E., lie on the slopes between the watershed and the almost flat plains of Cheshire and the vales of York and Trent.

Farther S. the carboniferous rocks only appear in detached fragments in the midland coalfields between the Trent and the Stratford Avon; in the mountain limestone and the Forest of Dean coalfield on the edge of the Old Red Sandstone of the Wye and Usk.

The New Red Sandstone

On the E. margin of the carboniferous rocks, along a line from the mouth of the Tyne to that of the Exe, are detached portions of the Permian system. From Tynemouth to Nottingham both Permian sandstone and magnesian limestone appear in long narrow bands.

Triassic rocks cover a V-shaped area reaching from Middlesbrough to Gloucester, and from Gloucester to the shore of Morecambe Bay. Detached portions fringe the coast of the Lake District, form the valley of the Lower Eden, and extend across the isthmus of the Cornish peninsula. Their best known representative is the New Red Sandstone. Triassic rocks are associated with lowlands, the vale of York, the valley of the Trent, the Cheshire plain, the Fylde of Lancashire, and the lowlands W. of the Severn.

The remaining portion of England comprises rocks which have no representatives on the W. The Lias stretches in an almost unbroken band from Lyme Regis, E. of the Severn and the Stratford Avon, E. of the Trent, and from Goole to the coast near the mouth of the Tees. Fringing the lias along its eastern margin lies the oolitic limestone, which gives rise to a line of residual hills, from the Cotswolds to the N. York moors.

Between the Wash and Dorset a narrow band of Greensand separates the oolite from the chalk which gives rise to a series of hills—the E. Anglian Heights, the Chilterns, the Marlborough, and N. and S. Downs. Within the V-shape of these hills lies the London basin with its young rocks.

ENGLAND: AREA AND POPULATION OF EACH OF THE 41 COUNTIES

County	Area (acres)	Size Order	Population	Pop. Order
Bedfordshire	302,942	37	311,844	32
Berkshire	463,830	32	402,939	28
Buckinghamshire ..	479,411	30	386,164	30
Cambridgeshire ..	555,118	25	255,901	37
Cheshire	649,424	20	1,258,050	12
Cornwall	868,167	14	345,612	31
Cumberland	973,146	11	285,347	35
Derbyshire	643,572	21	826,336	16
Devon	1,671,377	3	798,283	17
Dorset	622,843	24	201,157	33
Durham	649,427	19	1,463,416	10
Essex	977,760	9	2,043,574	5
Gloucestershire ..	804,932	17	938,618	13
Hampshire	1,055,817	7	1,292,211	11
Herefordshire ..	538,924	27	127,092	38
Hertfordshire ..	404,523	35	609,735	21
Huntingdonshire ..	233,985	38	69,273	39
Kent	975,960	10	1,563,236	9
Lancashire	1,201,888	6	5,116,013	1
Leicestershire ..	532,385	28	630,893	20
Lincolnshire ..	1,704,369	2	706,574	19
London	74,850	41	3,348,336	3
Middlesex	148,691	39	2,268,776	4
Monmouthshire ..	346,781	36	424,647	26
Norfolk	1,314,240	4	546,550	23
Northamptonshire ..	638,612	22	423,334	27
Northumberland ..	1,291,978	5	798,175	18
Nottinghamshire ..	540,015	26	841,083	15
Oxfordshire	479,173	31	275,765	36
Rutlandshire	97,273	40	20,510	41
Shropshire	861,800	15	289,844	34
Somerset	1,032,325	8	551,188	22
Staffordshire	738,513	18	1,621,013	7
Suffolk	948,270	12	442,439	25
Surrey	461,833	33	1,601,555	8
Sussex	932,503	13	936,744	14
Warwickshire ..	628,994	23	1,860,874	6
Westmorland	504,917	29	67,383	40
Wiltshire	860,611	16	387,379	29
Worcestershire ..	447,679	34	522,974	24
Yorkshire	3,897,399	1	4,621,698	2

crease of births. Under the redistribution of 1948, England was divided into 215 co. constituencies plus 291 bor. constituencies, each returning one M.P.; in 1955 the total number was raised to 511.

GEOLOGY. The situation of England with reference to France and the continent of Europe is of supreme importance. The E. and S. coasts make an angle with its vertex just where the British seas are narrowest. Through this S.E. corner Continental civilization reached England, and through it England maintains its closest ties with modern Europe. The English land consists of rocks representative of many more geological ages than are encountered elsewhere in the British Isles.

Silurian rocks and large massive or eruptive basalt. The Cornish peninsula and Herefordshire are mainly Old Red Sandstone and Devonian rocks with eruptive granites in Cornwall. Here the rivers have bitten into the rocks and carved the upland into steep-sided, narrow winding valleys. Between rounded smooth-topped ridges and domes lie marshy alluvial flats, where the streams meander across valley bottoms made by more powerful torrents. In the Lake District the ice sheet gave a slightly different character to the land surface, and in the valleys carved by glaciers long narrow lakes walled by steep slopes radiate from a central knot of mountains, the result of former volcanic action.

The N. and S. Downs are relics of a ridge of chalk which was raised as the Wealden uplift to form a continuous ridge from Wiltshire to France. The middle of the ridge has been worn away to form the Wealden plain and expose the Greensand along the inner scarped edge of the chalk, the Wealden clay within the Greensand, and the Hastings Sand within the clay.

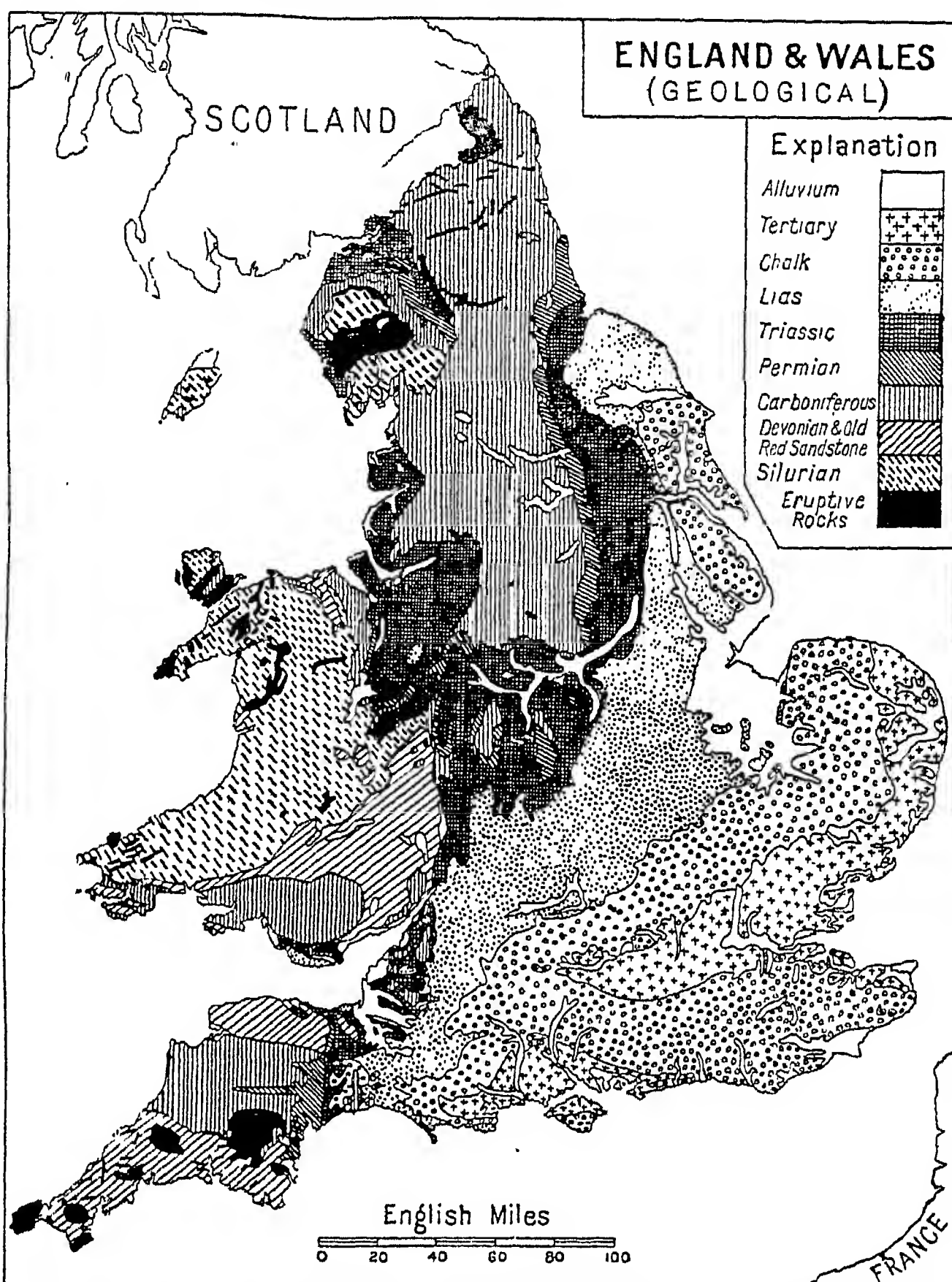
Scenic Differences

Each of these geological horizons has been weathered into characteristic land forms. The steep cliff faces of the Millstone Grit in Derbyshire are in striking contrast to the chalk landscape of the downs, marked by rounded contours. The Triassic landscape of the vale of Trent or the Cheshire Plain differs widely from either the oolitic Oxford Clay or the younger London Clay of Herefordshire or Middlesex.

These scenic differences are emphasised by the vegetation typical of each type of rock. The beeches and silver birches of the sandstone of Sherwood Forest differ widely from the woodland which clothes the sides of the narrow Cornish valleys and leaves the uplands bare.

Similarly, the coastal edges of the formations give an infinite variety to the shores of England. The chalk cliffs of Dover and Beachy Head, with their vertical white faces, differ from the sandy cliffs exposed near Bournemouth in the eocene of the Hampshire basin; the miles of iron-bound coast along N. Cornwall from Tintagel southwards are totally different from the sandy lowland shores of the Triassic formation in the Wirral peninsula. In Norfolk and Suffolk the cliffs are noteworthy for their yellow, orange, and reddish hues, their friable texture and tendency to fall away. They are among the newest of England's cliff formations.

RIVERS AND VALLEYS. Although the highest ground of England is largely due to those foldings of the earth's crust which produced the Pennine and Wealden uplifts, the residual features are largely the work of rivers. In the N.E., in Northumberland and Durham, the North Sea drainage reaches to a water-parting on the western side of the Pennines; near Cross Fell (2,930 ft.) the Tyne, Wear, and Tees rise close to one another. From Haltwhistle the S. Tyne and the Tyne itself flow due E.; the valley of the S. Tyne leads W. through the Tyne Gap in the Pennines at a lower elevation than 500 ft. to Carlisle. The Coquet, Wansbeck, and Blyth cross the coastal plain of Northumberland, and the Wear



England. Map showing the general geological formation of England and Wales

and Tees for more than half their length find their way along the Durham lowland.

Between Teesmouth and the Wash almost the whole of the drainage is concentrated on the Humber. The large rivers, except the Yorkshire Derwent, rise towards the W. side of the Pennines, the Trent even on the western slopes, and drop through the dales to the level of the Triassic sandstones and marls in the plains of York and Trent. Richmond, Leyburn, Ripley, Sheffield, Stoke-on-Trent, the first large places on the rivers, mark the termination of Pennine valleys. Lower down stream the rivers flow over the sandstones to the main streams of Trent and Ouse which flow parallel and close to the E. edge of the Trias.

The drainage has hollowed the sandstone into a trough with Lias clays on the E. The Yorkshire Derwent is the one exception to the rule that no long rivers cross the Lias to the Triassic plain.

This stream rises close to the coast, flows across the oolitic vale of Pickering between the Cleveland Hills and the Yorkshire wolds in an abnormal course which was determined originally by the presence of sea ice during the ice age in the North Sea. This ice barrier forced the drainage towards the S.W., so that a permanent valley was carved across the Lias clay.

The Wash, Witham, Welland, Nen, and Great Ouse rivers rise on or close to the Lias, and carving out the low residual oolitic hills, drain the trough of clayey land bounded on the E. by the chalk ridge N.E. of the Chilterns. The water gap at the great bend of the Witham is dominated by the city of Lincoln on the oolite ridge above the river.

Probably the Thames once flowed over dry land to join the Rhine and make a great river which flowed N. across the North Sea floor. The Yare, Waveney, Orwell, Stour, Colne, Blackwater,

and Crouch are thus the relics of longer streams which drained from the chalk ridge eastwards to this parent stream. The Kennet rises in the angle where the Chiltern and Downs chalk ridges meet in the Marlborough downs, and flows in a straight course to the Thames at Reading in the general line towards Southend. This is the real lower Thames, with all the left bank tributaries, Colne, Lea, etc., coming down from the chalk across the London clay.

The upper Thames makes a great break through the chalk at the Goring Gap to reach Reading, and the shape of its basin in the Oxford clay plain between the Cotswold oolitic ridge and the Chilterns is due to the general drainage to the S.E. and the sideways drainage in the clay hollow.

River System and Market Towns

The Churn, Coln, Leach, Windrush, Evenlode and Cherwell and the Thames itself between Oxford and Reading flow to the S.E.; the Ray and the Thame (vale of Aylesbury), the Ock (White Horse vale), and the Thames above Oxford flow at right angles to this main direction across the clay.

The Wealden rivers rise along a water-parting which roughly follows the line from Hythe to Hindhead. From the northern clay vale the Wey, Mole, Medway and Stour cut through the N. downs. The Arun, Adur, Ouse and Cuckmere cut through the S. downs to the English Channel. The Rother alone is entirely on the Weald, and crosses the Hastings sand.

The Itchen, Test, Avon, Stour and Frome flow from the chalk to the Hampshire basin. The Avon drains Salisbury Plain. All around the coast from the Wash to Poole harbour the rivers reach the sea along a low coast, where the rise and fall of the tides makes a great difference to each estuary.

The river system in general has determined the situation of the market towns. Guildford, Arundel, and Lewes are gap towns on the downs. Oxford, Reading, Chelmsford, and Norwich have each been influenced by the confluence of two streams.

The peninsular rivers of the S.W. are developed from the Exmoor, Dartmoor, and Bodmin moorlands. The Tamar and Torridge, rising in the Ditchen Hills inland from Hartland Point, are exceptions; the valley of the Tamar makes a lowland way across the peninsula. Falmouth Bay is a typical Cornish estuary. The rivers of the oldest rocks in England are tiny streams which flow into large rock-walled estuaries

which are the drowned valleys of the middle or lower courses of the streams; they indicate a period when the streams were larger, longer, and more powerful, and which preceded the inflow of the sea or the sinking of the coast. The Camel estuary is the only large break in the iron-bound coast of N. Cornwall between St. Ives and Hartland Point; here miles of sand at low water attest the fact that the estuary is too large for the tiny stream which drains into it; the river and estuary are not conformable.

The Parret, Brue, Axe, and Bristol Avon belong to an area where many geological formations are crowded together. The Parret is bounded S. by greensand hills, like Leith Hill in the Weald; the Brue and the Axe belong to Sedgemoor, a fen district in miniature with the limestone Mendip Hills to the N. The scenery of the Mendips repeats that of the Peak district, with lead mines, swallow holes, and caverns. The Cheddar Gorge is, however, without parallel in Derbyshire; the cliffs are probably the sides of a great cave of which the roof has fallen. The Bristol Avon rises in the oolitic Cotswolds, crosses the S. portion of the Oxford clay plain, cuts a gorge through the oolite, crosses a lias clay plain, and cuts a second gorge at Clifton through the carboniferous limestone of the Bristol coalfields to the Bristol Channel.

The Severn and Thames

The Severn is a Welsh river of which the middle and lower courses are English. It originated probably as one of a series of streams which flowed in a general S.E. direction from the Cambrian mts. The young stream, in all probability the parent stream of the Thames, flowed across a slope where the surface features were of small magnitude. In time the softer clay rocks of the lias and the oolite were worn away, leaving outstanding sandstone and limestone hills and ridges. Struggles were initiated between the streams and the harder rocks; there was a chance that the Cotswold and Chiltern ridges would cut the young stream into three sections. The Goring Gap was cut through the chalk, but no gorge was made in the oolite, and the young stream grew into two rivers—the Thames and the Severn. On the one hand the Severn is parallel to the Cotswolds and the general lines of the Thame, Thames, and Upper Bristol Avon; on the other, it lies on the lias clay, close to the edge of the Trias, and is related in this respect to the lower Trent.

The vales of Evesham and Berkeley resemble the vales of Newark and York. Above the confluence with the Stratford Avon between Tewkesbury and the Coalbrookdale Gorge at Ironbridge, the Severn valley belongs to the Trias; the Worcester plain is like the plain of Burton on the middle Trent. The Tems, Wye, and Usk may be considered as Severn tributaries. In their English sections they cut valleys in the Old Red Sandstone.

Lancashire and Cheshire Estuaries

The Triassic plain of S.E. Lancashire and Cheshire is drained by the Mersey and its affluent the Irwell, the Weaver, and the lower Dee. Their outlets to Lancashire Bay, the Mersey and Dee estuaries, are not conformable with the streams themselves. In both rivers the estuaries are being silted up; sandbanks a few feet below the sea continue the Wirral peninsula far to the N., the main channel winding at low water as a narrow stream across the sand-choked Dee estuary. The bottle-neck formation of the Mersey estuary assists the daily scour of the tides, but large dredgers have to be maintained to provide a regular channel for liners. Ribblesdale belongs to the mountain limestone of the Pennines, and connects with Airedale at the Aire Gap.

Lonsdale is a reminder that the Lune is a Pennine stream with a silt-filled estuary. The tiny streams of the Lake District which reach Morecambe Bay are really longer than the map indicates, since they form definite valleys across Morecambe sands and have lower courses which are only obscured at high tide. The Eden rises close to the sources of the Swale and Ure, flows across Permian sandstone to the Triassic Solway Plain; its affluent, the Irthing, completes the Tyne Gap in the Pennines. Like all the Triassic bays, Solway Firth has vast stretches of sand exposed at low tide. The Lake District culminates in Scawfell, but the lake valleys radiate from Helvellyn. Windermere, Conistone Water, Wastwater, Ennerdale Water, Buttermere, Derwent Water, Bassenthwaite, Thirlmere, Ullswater, and Hawes Water are typical lakes of a glaciated area, and fill part of the narrow dales which lead downwards between tree-clad ridges from the central dome where ancient sedimentary rocks are exposed in Skiddaw, and intrusive volcanic rocks raise weathered peaks, as at Scawfell. Walney Island and the coast from Foulney Island to S. Bees Head is Triassic lowland. Windermere, Ambleside and



England. Map indicating the mean actual annual temperature of England and Wales

Keswick are examples of settlements where a route leads from one dale to another.

The shallowness of British seas and the gradual shelving of the English shore are important in reference to the rhythmic pulsations of the tides. In few countries is the tidal effect felt so far up the rivers. In the characteristically English unconformable estuaries the scour of the tides keeps open the regular channels, with the result that there are scores of tidal harbours round the English coasts. No part of England is more than 70 m. from a section of this tide-swept coast.

CLIMATE AND WEATHER. Ultimately, the climate depends upon degree of insolation and on currents in the atmosphere between the lower surface inhabited by man and the isothermal layer 5-6 m. up. The lower faces of these currents are disturbed into eddies by the varied configuration of the land surface, but the general movements are steady and continuous. The climate of England is determined within wide limits by the intensity of the sun's rays which it receives; because of its situation England is not tropical like Ceylon, nor arid like Egypt, nor a frozen waste like Spitsbergen.

The limits set to its climate by its latitude are far apart. The precise range of the climate is determined by atmospheric currents, which move in relation to three areas of definite types of atmospheric pressure. To the

land has the mildest winter of any part of the world in corresponding latitudes. These results are chiefly due to clouds and consequent rain. England has usually a high percentage of cloud-covered sky, which serves the double purpose of a blanket in winter and of a screen in summer.

In winter, when the earth should cool rapidly and dissipate the warmth stored in summer, the clouds restrict the radiation of heat, condense into relatively warm rain, and in so doing release heat and bring muggy, foggy days. In summer, the clouds screen England from the fierce rays of a sun high in the sky, and supply frequent rains. As more water is evaporated in summer than in winter frequent rainfall means a lowering of the temperature by the absorption of the heat necessary to change the water into gaseous moisture. An English July may therefore be cool and rainy.

S.W. over the Atlantic lies the Azores area of high pressure; to the E. over the mainland, pressure is usually high in winter and low in summer; to the N.W., over the Atlantic, pressure near Iceland is usually low.

The prevalent surface winds are, therefore, those with a westerly direction, which bring oceanic influences to bear. As these winds are usually moisture-laden, rather warm in winter and cool in summer, English seas, rivers, and lakes are seldom frozen, and Eng-

The isotherms, which indicate corrected temperatures at sea level, show that in July London is hottest, over 64° F., and the strip of land along the Scottish border is coolest, below 59° F. But in Jan. Land's End is warmest, over 44° F., and the E. coast from Flamborough Head to the Nore is coldest, below 38° F.; London is no warmer than Carlisle or Berwick, Liverpool is as warm as Southampton. In summer the isotherms run E.-W. and in winter N.-S.

The actual weather probable at any English town is determined by local conditions of elevation and slope and by general variations from the normal. The prevalent winds usually reach England as depressions following more or less definite tracks from the Atlantic; sometimes the storms are fended away from England because the continental high pressure extends over the S.E. and brings clear skies, cool nights, and a frosty period in winter; at other times the Azores high pressure approaches the S.W., and Cornwall has a succession of bright, sunny days while in the N. the weather is cloudy, cool, and wet.

These general variations affect the entire country, while the surface configuration introduces purely local variations. The annual temperature of England, were it entirely a plain, would lie between 48° F. and 54° F.; the map shows that it actually lies between 38° F.



England. Map showing the annual distribution of rainfall in England and Wales

and 52° F., and that the hills are cooler than the lowlands. Really the S. coast, the London area, and the lowlands of the S.W. are warmest, the Lake District is coldest, and the Vale of York is as cool as the tops of the N. Downs or the Chilterns. The rainfall map shows primarily the effect of elevation; the wettest place in England is in the Lake District, and even minor ridges are wetter than the plains beneath; the tops of the Downs receive more rain than the Weald plain. But rain clouds come from the ocean, so that the W. of England is wetter than the E. Dartmoor and Bodmin Moor are wetter than the Peak, and the 500 ft. level on the Lancashire slope of the Pennines receives 10 ins. more rain a year than the corresponding level on the Yorkshire slope; Holderness is drier than the Wirral.

The actual number of hours of sunshine experienced in England varies considerably: e.g. Cornwall, Essex, and the S. coast receive yearly about 1,700 hours, the E. slopes of the Pennines less than 1,200 hours. But the difference is largely neutralised by the slope of the ground. Although the sun shines almost equally upon both sides of the S. Downs the southern slopes are so tilted that the sun's rays have an increased heating effect, while the northern slopes are tilted away from the sun.

The climate and weather of England have, therefore, a definite character. There are few extremes, there is constant change, and, within a small area or a short period, considerable variety.

MOVEMENTS OF POPULATION. Celt, Saxon, Dane, and Norman left their impress upon the English people, and the prosperity of England later attracted Welsh, Scots, and Irish from within the British Isles and strangers from the Continent. British freedom drew many immigrant aliens from Central Europe, particularly the Jews. Consequently, the English people is almost as kaleidoscopic as the English rocks or English weather. The total of nearly 38 millions is unevenly distributed over 51,000 sq. m. England contained two-thirds of the population of the British Isles in 1871 and three-quarters in 1911; the rate of increase per decade has gradually diminished from 134 per thousand, 1861-71, to 105, 1901-1911. In 1801 the population was 8,900,000, and in 1851, 17,900,000.

The Pennine, N. Yorkshire and Cornish moors, and the Cumbrian Mts. are uninhabited; in the in-

habited areas there is a continuous gradation towards definite areas of concentration. Roughly, in a belt of country stretching from Weymouth across Salisbury Plain and the Clay Vale to near Peterborough, past Lincoln and Gainsborough to York and the N. half of the plain of the Tees, the population is least dense. E. of this belt there is approximately a steady increase towards the London area. W. of it there are several foci of population. Bristol, the Black Country, the Potteries, the inverted sickle of S.E. Lancashire, and the W. Riding with the continuation to Derby and Nottingham, the Durham district from Darlington to Newcastle—all these are crowded, and the population gradually thins out away from these centres.

Varying Areas of Population

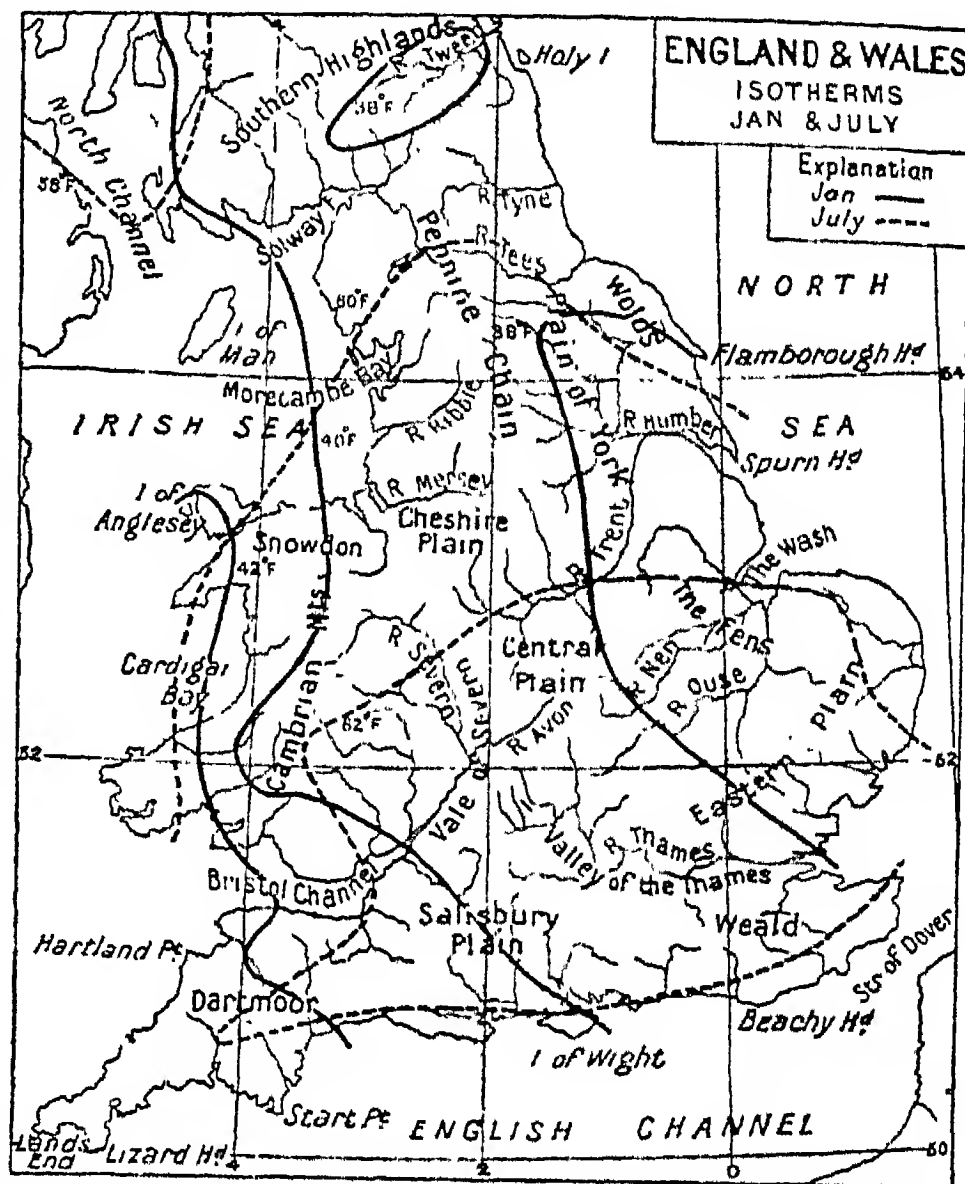
A closer examination of details indicates that the areas of dense population such as the London district include nuclei of very dense population grading off to areas of relatively few inhabitants. Consider the area composed of the counties of Cheshire, Derbyshire, Nottingham, and the N. half of Staffordshire. In 1801 more than half the area had fewer people than 128 per sq. m. In the W. half Chester, Nantwich, Northwich, Macclesfield, Stoke, Stockport, and Altrincham were small urban areas with at least 1,920 people per sq. m. In the E., Derby, Nottingham, Newark, Retford, and Chesterfield were similar urban areas. By 1851 the areas of sparse population had grown smaller and the urban areas exceeding 1,920 per sq. m. were more numerous along certain definite lines, from Birkenhead to Stockport along the Mersey, from Stoke N. to Macclesfield, from Derby N. to Chesterfield; the Nottingham nucleus was larger, but those of Chester, Retford, and Newark were unchanged.

By 1901 the areas of sparse population were nearly as large as in 1801; the rural areas were being depopulated. The urban nuclei, already developed in 1851, had be-

come larger except at Newark. New nuclei had grown along the lines already noted, but the greatest change occurred near Nottingham, where a small urban area had expanded to make almost a complete ring something like 5 m. wide. Throughout two-thirds of the area the population was less numerous in 1901 than a century earlier; in parts there had been an almost continuous decline, elsewhere there had been growth until 1841 and subsequent decline. The urban areas already specified had multiplied their numbers by from 4 to 10 times. Near Birkenhead, round Stoke, in a belt of country from Nottingham to Chesterfield, there occurred exceptional growth.

General Conclusions

An inquiry into the circumstances attendant upon these changes yielded the following conclusions. The purely farming areas either absolutely declined in numbers or increased by little more than 50 p.c. In the lead-mining districts the population was almost stationary until the mines failed, when it declined absolutely. In the colliery districts the population increased approximately eightfold. In the salt-mining areas of Cheshire the people increased steadily. In the districts where cotton factories were established growth in population was rapid, but the failure of factories established in unsuitable localities during the boom caused a decline. Results may be summarised thus: the industrial development of the area



England. Isothermic map, in which points recording the same temperature at a given time are joined by lines

attracted the people from the farms and also drew to the urban nuclei large numbers from other parts of England. Similar conclusions may be drawn from an investigation of the population of the West Riding.

The above is a general commentary on the period since the industrial revolution. Modifications have occurred in the 20th century, the depression in northern industries having induced a southward trend of the population, although the 1951 census showed in the N. as well as in the S. a strong concentration in huge industrial areas at the expense of smaller towns. All the pops. in the list below relate to the areas as constituted on April 1, 1951, except the 1931 pops. of places marked *, which relate to the slightly different administrative area of those places in 1931. All these places fall into three geographical classes: manufacturing towns on or near the coalfields of the N. and Midlands; seaports, harbours, and

seaside resorts; dormitory towns near London. Norwich is the only place exceeding 100,000 inhabitants outside these groups. Other towns may be devoted to a specialised industry, *e.g.* Burton-on-Trent; of historic, ecclesiastical, or educational importance, *e.g.* York, Winchester, Canterbury, Oxford, Cambridge; transport centres, *e.g.* Crewe, Swindon; catering for holiday makers, invalids, and retired folk, *e.g.* Bath, Buxton, Harrogate, Scarborough; or show places like Stratford-on-Avon.

INDUSTRIES. Though England grows wheat, oats, and barley, and raises cattle and sheep, these products supply only a fraction of the cereals and meat required by the inhabitants, with the result that England is proportionally the greatest food importing country in the world. The wheat is grown chiefly N. of the Thames, and E. of a line drawn from London to Goole. Oats thrive in the lowlands. Large county yields are in the E. and Cheshire. Barley is grown in dry Norfolk, Suffolk, and Lincoln; the dryness of the harvest improves malting quality. Beet sugar, especially in the E., was introduced comparatively late.

Cattle are most numerous in the W. lowlands, extending from the plains round Morecambe Bay in a wide sweep along the Severn valley into the Cornish peninsula, where the rainfall exceeds 40 ins. annually, and the clays and alluvial flats yield rich meadow grass. The great centres of population have brought into existence small farmers with small herds of milkers on poor grass land. In Cheshire the dairymen supply the cotton towns with milk, and make cheese. Derbyshire and Leicestershire produce Stilton cheese. Cornwall is rich in cattle, the milk being made into butter and clotted cream. In Devon the cattle are likewise reared for their milk but also for the butcher.

As to sheep, the short pasture and dryness of the chalk hills of Kent, Wiltshire, Dorset, Lincolnshire, and the East Riding are specially favourable. The hill slopes of Shropshire, Hereford, Monmouth, Northumberland, and Cumberland support other flocks.

To indicate the effect of climate and locality on the farmer's work, four counties may be compared: Essex, dry and near London; Lincolnshire, equally dry but distant from dense areas of population; Cheshire, wet and near populous S.E. Lancashire; Devon,

wet and with few towns. Essex has an exceptional area under wheat; its minor crops are beans, peas, potatoes; glasshouses supply grapes, tomatoes, etc., to London; there are seed and fruit farms; rose culture is important; the cattle, below average in number, supply milk to London. Lincolnshire has a large acreage under barley, and grows peas, beans, potatoes, and other roots; Lincoln shorthorns are good milkers and Lincoln sheep are exported for breeding. The west has a relative excess of permanent pasture. Cheshire cattle are chiefly dairy cows, its cheese is famous, and it grows potatoes and root crops. The wheat acreage of Devon is remarkably low, while fruit is abundant, sheep are in excess of the average, and cream is celebrated.

The chief English fishing towns are on the E. coast, Grimsby, Yarmouth, and Lowestoft accounting for most of the catch on this coast, which amounts to three-quarters of the English total. Newlyn is the chief fishing centre on the S. coast, and St. Ives and Fleetwood on the W. The main catch in the North Sea is herring, in the Channel, mackerel and pilchard.

Coal and Other Minerals

Coal is the chief mineral of England, which in 1914 yielded a fifth of the world's output, employing a million workers. Not only carboniferous rocks composed the coalfields, for those of York, Derby, and Nottingham have an indefinite boundary under the newer rocks to the E. of the carboniferous series; thus coal may be found at greater depths on the E. margins. Iron came from the coalfields, where the ore was found between beds of coal, and in Cleveland and Furness there are large deposits of haematite ore.

Lead-mining, located chiefly in Derbyshire, has been declining for many years. Cornwall produces tin. Zinc is found in Cumberland, manganese in Cornwall and Devon, tungsten in Cornwall. The most important non-metallic mineral is salt, found chiefly in the Nantwich district, also in Lancashire, Worcestershire, and Durham. Potassium is found in Yorkshire.

The most important English manufactures are textiles. Cottons are focused on Manchester; the chief districts are Blackburn, Oldham, Bolton, Stockport, Preston, and Rochdale. Woollens are chiefly made in the West Riding, with Bradford as a technical and Leeds as a marketing centre, the other

	Pop. 1951	Pop. 1931
London	3,348,336	4,397,003
(Greater London)	8,346,137	8,215,673
Birmingham ..	1,112,340	1,002,603
Liverpool	789,532	856,072
Manchester	703,175	766,311
Sheffield	512,834	518,257
Leeds	504,954	482,827
Bristol*	442,281	403,948
Nottingham	306,008	276,189
Hull (Kingston upon Hull)	299,068	313,649
Bradford	292,394	298,692
Newcastle upon Tyne	291,723	286,255
Leicester	285,061	257,718
Stoke on Trent ..	275,095	270,639
Coventry	258,211	178,126
Croydon	249,592	233,108
Portsmouth	233,464	252,421
Harrow	219,463	96,656
Plymouth*	208,985	213,038
Ealing	187,306	116,771
Ilford	184,707	131,061
Sunderland*	181,515	185,903
Willesden	179,647	185,025
Southampton ..	178,326	176,007
Salford	178,036	223,438
West Ham	170,987	294,278
Bolton	167,162	177,250
Wolverhampton ..	162,669	138,631
Brighton	156,440	147,427
Hendon	155,835	115,640
Southend-on-Sea ..	151,830	129,783
Middlesbrough ..	147,336	138,960
Blackpool	147,131	106,095
Bournemouth	144,726	116,803
Birkenhead	142,392	151,513
Stockport	141,660	126,362
Derby	141,264	142,520
Wembley	131,369	65,799
Huddersfield	129,021	123,048
Tottenham	126,921	157,667
Norwich*	121,226	126,236
Oldham*	121,212	140,814
Walthamstow	121,069	132,972
East Ham	120,873	142,394
Preston	119,243	119,665
Gateshead	115,017	124,545
Dagenham	114,588	89,362
Walsall	114,514	103,059
Reading	114,176	97,149

chief districts being Huddersfield and Halifax. The manufacture of woollens extends W. to Rochdale, that of cottons E. to Halifax and Bradford. Silk goods are made over a wider area and on a smaller scale, the main centres being Bradford, Stockport, Halifax, Stoke, Birmingham, and London. Leicester, Nottingham, and Derby make lace and both cotton and woollen hosiery. The distribution of the textile industry is largely controlled by the S. Pennine coal-fields.

Because England took the lead in manufacturing on a large scale, her manufactures of iron and steel were for a long time more important in rly. construction and shipbuilding than those of any other country. Smelting operations are usually carried out near the mines, especially in Cleveland and the Black Country. Pig iron is made to the extent of about 7,000,000 tons annually: forge and foundry, Bessemer, haematite, and basic; for these purposes iron ore is imported chiefly to Middlesbrough to supplement local supplies. Steel is made chiefly by the open hearth process.

Sheffield steel and Birmingham hardware are world famous.

The chief shipbuilding district in normal times has been between the Tees and the Tyne. Shale and crude oil are produced in the North. Birmingham, Wolverhampton, and Coventry have been versatile in their products. Other manufactures are specifically localised. The Potteries on the N. Staffordshire coalfield use local clay and coal for making crockery and earthenware. Northampton and Leicester are centres for boot and shoe manufacture. Chemicals, alkali, and soaps are made chiefly near the Mersey. Steam-driven flour mills are located at the wheat-importing ports, London, Hull, etc. Burton beer, Leeds ready-made clothing, Bristol tobacco, Reading biscuits, may be named.

COMMUNICATIONS. The English railways radiate from London. In 1923 four great groups were formed, the object being the economy resulting from joint management and administration, and elimination of losses due to competition. The groups were as follows: (1)

Southern Railway; (2) Great Western; (3) London, Midland, and Scottish; (4) London and North Eastern. These four groups formed the basis of the five English regions of British Railways that came into being after the nationalisation of the railways in 1948. The five regions are: (1) Southern region; (2) Western region; (3) London Midland region; (4) Eastern region; (5) North Eastern region. From the 1920s there was extensive electrification of suburban and S.R. lines.

English barge canals (*see* plate facing p. 1704) have been neglected through rly. competition. The only ship canal of importance has made Manchester the fourth port of the country and brought ocean steamers some 30 m. inland, almost to the doors of the cotton factories.

The main roads radiate from London to all points of the compass; *e.g.* A 1 (ministry of Transport classification) to Edinburgh; A 2 to Dover; A 3 to Portsmouth; A 4 to Bath; A 5 to Holyhead; A 6 to Carlisle. Two great routes do not touch London; from Sheffield through Birmingham, Gloucester, Bristol, and Exeter to Land's End, and from Chester through Shrewsbury and Hereford to Gloucester.

Regular internal air services operate between England and Scotland, Wales, the Isle of Man, N. Ireland, the Channel Islands, and the Scilly Isles.

COMMERCE. England is still among the greatest markets in the world. The need to supply the population has brought about cold storage for mutton and beef, perishable fruits, etc., and has caused great developments in canning, drying, or preserving foodstuffs. Wheat is harvested, and fruits are picked somewhere in the world every week, and consequently the world can send to England a continuous stream of foodstuffs; the products of the S. hemisphere, wheat, mutton, beef, butter, fruits, etc., are at their best when the supplies of the N. begin to fail. In addition to these supplements to home supplies, tea, coffee, rice, etc., are imported. But England is a market for raw materials as well as foodstuffs. She buys the specialities of other lands, and partly pays for these imports by the services of merchant shipping, of the technical experts lent to other lands, and by the export of coal and manufactures.

London and Liverpool rank among the greatest seaports of the world. They are approximately



England. Map showing the principal railway routes of England and Wales

equal in total value of trade in normal times, but London has an excess of imports, while at Liverpool exports and imports balance. Hull, Manchester, Southampton, Newcastle-upon-Tyne, Grimsby, Goole, Bristol, Harwich, Newhaven, Dover, and Folkestone are other ports.

CONSTITUTION AND GOVERNMENT. The constitution of England has been extended to apply to the United Kingdom since 1707 and with varying degrees of alteration to Northern Ireland, Eire, the dominions and colonial possessions. It is democratic, but that is probably the last way in which it would be described by a casual observer paying more attention to forms than realities. That framework of government which in the Middle Ages gave it an oligarchical tinge and under the Tudors made it almost a dictatorship still in theory remains unchanged. During all these periods England has had a legislature consisting of the sovereign and two houses of parliament, and the sovereign has been the source of executive power. Great changes there have been; usually they have been gradual, but even when more violent, as in the revolution of 1688-89, the framework has been untouched except for the break during the interregnum, whose very name indicates impermanence. The constitution has never been completely recast, for England has had no true revolutions.

Influence of Custom and Convention

Many important changes are due not to the alterations in the law but to the growth of customs and conventions. There is no law which says that parliament must meet once a year; nor to prevent the crown from refusing its assent to any bill passed by the two houses of parliament; yet parliament does meet every year and no sovereign has refused assent to a bill since 1707. Most royal powers are actually exercised in the name of the sovereign by ministers answerable to the house of commons. Conventions do often depend indirectly on some law. If parliament did not meet every year it would be impossible to carry on the work of government, as no money would be available since taxation must be imposed each year by Act of Parliament. No army could be maintained, for the Army Act authorising its maintenance has to be passed each year.

The English constitution is flexible, not rigid like that of the United States, contained in

one formal document capable of alteration only by special procedure. There are Acts of Parliament and constitutional documents of great importance—Magna Carta, 1215; Petition of Rights, 1628; Bill of Rights, 1689; Act of Settlement, 1701; but these are on no different footing from other Acts. It would be open to parliament in one day to pass an act repealing every one of them, using procedure no different from that employed to repeal any other Act.

Relation of Executive and Legislature

Another characteristic is that the executive is responsible to the legislature. This means in practice today that the government is formed from members of the political party which commands a majority in the house of commons, and can hold office only so long as it is supported by that house. In the U.S.A. the executive is not responsible to the legislature. The president is head of the executive and is elected for four years. It happened as a result of the congressional elections in 1946 that a congress with a strong Republican majority was returned although President Truman was a Democrat. A similar situation arising after the First Great War, when a Democrat president, Wilson, was in office with a Republican congress, was largely responsible for the American refusal to enter the League of Nations. Under the English constitution it is impossible for such a situation to arise.

A third English characteristic is the Rule of Law. The essence of this is the absence of any arbitrary power, and it is the main basis of English freedom. The Rule of Law ensures that the executive has no arbitrary power over a citizen, for he can be punished for anything he has done only if an impartial court sitting in public decides that he has infringed the law. It is vital to the operation of this Rule of Law that the judicature should be independent of the executive. A judge can therefore be removed from office by the crown only on a joint address of both houses of parliament; and his salary is paid out of the Consolidated Fund, *i.e.* is fixed by Act of Parliament and paid automatically each year, not coming before parliament annually as do the salaries of most public officials. Thus a judge who has to decide a case in which the executive is concerned need not fear to decide against the executive.

Montesquieu from a study of the English constitution derived the

doctrine that its effectiveness was due to the separation of powers, *i.e.* to the legislative, judicial, and executive powers being independent of one another. This doctrine had important results in the constitution of the U.S.A. which was based on it; but has never been strictly applicable to the English constitution. Legislature, executive, and judiciary are not completely separate. In particular, the executive has always exercised some legislative and judicial powers. These powers growing in recent years, their wide extent has been declared dangerous to freedom by many eminent lawyers, *e.g.* Lord Chief Justice Hewart in *The New Despotism*. In spite of this opposition, today vast numbers of laws are made not by parliament but by some government department under powers delegated to it, and many decisions as to rights of individuals are made not by the courts but by some official of a government department. A good example is afforded by the National Insurance (Industrial Injuries) Act, 1946, under which questions whether an employed person has been injured by some accident "arising out of and in the course of his employment" are to be decided in private by an official of the ministry of National Insurance, and not, as hitherto, in public by a court under the Workmen's Compensation Acts. Other examples of the exercise of legislative powers by the executive were afforded by thousands of regulations made during the Second Great War.

Government by the Commons

The legislature consists of king, lords, and commons; but in practice power lies with the commons and inside that house the party which enjoys a majority and forms the government can usually bring about the passing of such legislation as it pleases. The checks on the power of the government are practical rather than legal. Ministers must have some regard to public opinion as voiced by the press and representative bodies like chambers of commerce. To ignore it would lead to breaches within the party, a defeat of the government, and the holding of a general election. A prominent feature both in the house of commons and in the constituencies is the party system under which members are elected not for their individual qualities or policies but because they belong to one or other of the political parties. Likewise in the house members are expected

to vote in support of the party to which they belong.

Since 1911 the supremacy of the house of commons has been put on a legal basis, for the Parliament Act of that year provided that any bill (except a money bill or a bill extending the duration of parliament beyond five years) if passed by the commons in three successive sessions would become law on receiving the royal assent even though it was rejected by the lords. Money bills, *i.e.* bills relating to taxation, on receiving the royal assent become law if passed once by the commons, though rejected by the lords.

The executive consists of ministers of the crown with the prime minister at their head. The most important ministers form the cabinet, all normally of one political party, unless a coalition of parties is formed in time of crisis. In practice the cabinet decides what legislation shall be proposed in the house of commons. Occasionally Acts are passed which have been introduced by private members, *e.g.* A. P. Herbert's Matrimonial Causes Act, 1937. Each department of state is under the charge of a minister, although occasionally ministers whose presence and advice are desired are appointed without portfolio. Ministers must defend their departments in parliament. The departments are manned by permanent civil servants.

Functions of the House of Lords

The judiciary in civil matters consists of the house of lords, the supreme court of judicature, and county courts. The house of lords hears appeals from the court of appeal and when acting in this capacity does not consist of all the peers who take part in its proceedings when it is acting as part of the legislature. Legally every peer is entitled to attend, but for 100 years there has been a convention that on the hearing of an appeal no peer shall take part except the lord chancellor, the lords of appeal in ordinary, who are judges appointed for life, and peers who hold or have held high judicial office. The supreme court of judicature consists of the court of appeal and the high court of justice. The court of appeal hears appeals from county courts and from the three divisions of the high court: king's bench division, chancery division, and probate, divorce, and admiralty division. Judges of the king's bench division go round the country on circuit hearing civil and criminal cases.

Justice is administered locally in county courts which hear cases involving less than a certain amount of money.

Criminal cases are heard by benches of several lay justices in petty sessions or by one magistrate who is a lawyer. More serious cases are sent for trial before a recorder in quarter sessions or before judges of the king's bench division at assizes. In London the central criminal court (Old Bailey) takes the place of an assize court. An appeal lies from petty sessions to quarter sessions or on a point of law to the king's bench division; from quarter sessions, assizes, and the Old Bailey to the court of criminal appeal; thence in special cases to the house of lords.

Before the Statute of Westminster, 1931, no dominion legislation was valid if it was repugnant to the rules of English common law or any English statute. This continued to apply to colonial legislation.

LOCAL GOVERNMENT. Under the supreme control of parliament, the people of England enjoy a large measure of local government. Each unit is a democracy working through the representative system. The men and women of county, borough, district, and parish elect certain men and women to form a council which manages such matters as parliament has entrusted to it. In many, but not all, of these councils there is an element—the aldermen—not directly elected, but chosen by the elected councillors.

The main division, as far as local government areas are concerned, is the venerable one between county and borough, although the demarcation is by no means complete. The forty older counties (London is an exceptional case) of England have had some sort of local government for a thousand years, but the existing system dates from the Local Government Act of 1888. The officials who until that time governed the counties—lord-lieutenant, high sheriff, and magistrates in quarter sessions—retain their positions, but their powers passed almost entirely to elected bodies called county councils.

These councils set up in 1888 do not correspond altogether to the counties as they existed before. The three historic divisions of Yorkshire became the East, North, and West Ridings; Lincolnshire was divided into Holland, Kesteven, and Lindsey; Suffolk and Sussex each into East and West; from Cambridgeshire the Isle of

Ely, from Northamptonshire the Soke of Peterborough, from Hampshire the Isle of Wight, were separated; a new county of London was created from parts of Surrey, Middlesex, and Kent; each new division with its council. The councils hold elections every third year, and their powers over education, police, public health, and other matters are laid down in the Acts of 1888 and following years. Towards expenses they receive large sums from the government, but the balance they raise by a rate on all property within the county.

The Act of 1888 affected also the boroughs. It created county boroughs, placing them entirely outside the authority of the county councils, and thus established a system by which every place is in either county proper or county borough, and consequently every voter is represented in one or other council.

Excluding the county boroughs, every part of England is either a borough, an urban district, or a rural district; it is also part of an administrative county and is represented in its council.

What Constitutes a Borough

The borough is a place which has received a charter of incorporation. Its local government is regulated by the Municipal Corporation Act of 1835 and an amending Act of 1882. It is governed by a mayor and council consisting of aldermen and councillors. The councillors are elected for three years, one-third of them retiring every year, and they choose the aldermen, who form one-third of their number. A special class is formed by 28 into which the county of London is divided. They are subordinate to the London County Council; their powers are different from those of ordinary boroughs; although of considerable size, they are not county boroughs.

The country outside London and outside the provincial boroughs is divided into urban and rural districts, called into existence by an Act of 1894. Urban districts are the thickly populated areas which have not yet become boroughs; rural districts are the country areas. The division is not absolutely rigid, and some populous areas remain rural districts. Each is governed by a council, elected for three years. The head is called chairman, not mayor, and there are no aldermen. These councils work in general under the supervision of the county council.



England. Map of the country under the Anglo-Saxons, showing the divisions of the heptarchy and the territories occupied by the various peoples

HISTORY. The departure of the Roman legions in A.D. 407 left Britain without any controlling government, but the old system of local principalities soon revived. The N. was open to attack by the Picts and Scots, the W. coast to invasions from Ireland. About the middle of the 5th century, Jutes from Denmark made a permanent settlement in Kent. During the next hundred years, Angles and Saxons established themselves on the E. and S. coasts, pushing inland till they had mastered the country E. of a line running roughly from Dunbar to Portsmouth. During 560-613 the newcomers overran the midlands, pushing the Britons farther to the W., and thrust wedges up to the sea on the N. and on the S. of Wales. In 597 Augustine began to Christianise the invaders in Kent. Thence Christianity spread N. among them, to encounter and eventually (in England) supersede the older Celtic Church. In the 7th century Northumbria was the most power-

ful of the English states. In the 8th century the supremacy passed to Mercia, and in the 9th to Wessex.

The second half of the century saw a desperate struggle between the English and a new host of invaders, the Danes, who established their mastery over half the island, but were forced back by Alfred the Great. In the 10th century Edward the Elder and his sons subjugated the Danes, and the kings of Wessex became kings of England.

The Battle of Hastings

But the subjugation of the Celts on the Cumbrian hills and the Devon moors was slow and incomplete; while in Wales they successfully preserved their independence. In the 11th century Sweyn, king of Denmark, and his son Canute established a brief Danish dynasty; but on the death of the last of Canute's sons, Edward the Confessor was recalled to the throne of England. When he died in Jan., 1066, the English elected Harold, Godwin's son, as king, but the crown was claimed by William, duke of Normandy, who shattered Harold's

army at Hastings, and was crowned in London on Christmas Day, 1066.

During the next six years risings in the N. and W. compelled William to subdue the whole country by merciless force, and provided him with an excuse for confiscating much of the land and distributing it among his Norman followers, though a substantial number of small estates remained in English hands. Theoretically, the Norman king reigned as the legitimate successor of the Wessex kings, by the same laws, legislating with assent of the *Witan*, the assembly of magnates, occasionally expanded into the common assembly of such freeholders as might choose to attend. Actually the conquest effected a revolution, because all the magnates and half the barons or lesser landholders were now Norman instead of English; the law was interpreted by them in their own interests and they reduced many of their own tenants to serfdom or villeinage.

Rule of the Normans

William and his two sons, William Rufus and Henry I, were powerful monarchs who utterly crushed the attempts of the new baronage to ignore or defy the authority of the crown. They called to their support the English population, who were infinitely more hostile to the local Norman tyrants than to the crown, though William II was himself a tyrant. After a reign of 35 years, Henry was succeeded by his nephew Stephen, whose claim to the crown was disputed by Henry's daughter, Matilda or Maud. The reign was a long horror of anarchy; the strife for the crown wrought less havoc than the private wars waged against each other by the barons, who pillaged, robbed, and murdered on all sides. The evil days were brought to an end on the death of Stephen in 1154 by the accession of Henry II, grandson of Henry I, the first Plantagenet.

Henry, already by inheritance or by marriage in possession of half France, did great work in the reorganization of the government of England. The baronage on the whole cooperated loyally with the king in the work. Revenues were collected, and the higher courts of justice were conducted by the king's officers, removable at his pleasure; the practical freedom of appeal to the royal courts against local injustice was greatly extended. The old system by which the king's officers could call up the freemen of the shire in arms was revived, counterbalancing the feudal right of every baron to call upon his own tenants for military service, while incidentally, through the practice of

obtaining the formal approval of the Great Council for the measures upon which the king had decided, the idea developed that the Council had a right to be consulted. In the course of the reign a Norman baronage was planted in Ireland, and, through the formal homage of the Irish chiefs, the island was annexed to the English crown.

Henry's elder son, Richard I, left the governance of the kingdom to justiciars, while he himself was engaged on crusade or in his French dominions. Public spirit and respect for law developed, so that in the reign of Richard's brother, John, who repeatedly overrode the law for his own ends, the barons combined to wring from him Magna Carta. Incidentally, also, John's reign brought about the severance of Normandy and most of the Plantagenet possessions in France from the English crown, making the baronage of England an English baronage with exclusively English interests.

In spite of Magna Carta, John's son, Henry III, in the course of a reign of 56 years, persistently attempted arbitrary and illegal methods of government, choosing for his ministers his own or his wife's foreign kinsmen in place of the English nobles, who regarded such offices as due to themselves of right. At length the baronial party combined under the leadership of Simon de Montfort, in effect to transfer the supreme control from the hands of the king to baronial committees. Faction among the barons led to the fall of Montfort in 1265.

Henry III and Parliament

But he had championed two great principles—first, that the sanctity of the law was to be maintained as sternly on behalf of the commons as on behalf of the barons; and, secondly, that the government should rest upon the assent of the realm expressed through the common council of the realm, which was now acquiring the name of Parliament. The practice of summoning thereto elected representatives of the freeholders had been developing all through the century; Montfort in 1265 established the principle of calling also representatives elected by the boroughs. Montfort himself failed, but his cause had triumphed. Acting as champion of the law, he, like Cromwell four centuries after him, found himself compelled to ride roughshod over the law, to adopt unconstitutional methods of asserting constitutional principles. His mantle fell upon the man who had overthrown him, who, as Edward I, made the law supreme.

The reign of Edward I is a crucial epoch in the history of England. In it the English nation, finally consolidated and unified, realized that the common interests of all classes were of more importance to each than the antagonistic interests of individual classes and groups; that the law which should be directed to the good of all should be uniform and fixed. It was the great era of definition, regulation, systematisation. It declared, though not finally, the powers of the crown for raising revenue, the jurisdictions of the baronage, the rights of the national assembly to consultation. It established the law of inheritance, and the subjection of the clergy to the civil law. Above all, it defined for 500 years the constitution of the national assembly itself; this being in the Model Parliament of 1295.

Yeomen and Serfs

But while Edward succeeded in unifying England and shaping the structure of the constitution upon foundations which had already been laid, he was not equally successful in accomplishing his desire of extending the unification to the whole island. Hard fought campaigns in Wales brought her into the English system; the attempt to absorb Scotland upon pretexts of feudal law forced her into temporary and incomplete subjection tempered by persistent insurrection, and finally issued in complete failure during the reign of his son and successor, Edward II.

During the 13th century England had become definitely the Merrie England of the ballads. The old hostility of Norman and Englishman had disappeared. The rural population had fallen into the two divisions of those who had succeeded in preserving their legal freedom, the yeomanry, and those who had been thrust into serfdom or villeinage which bound them to the soil on which they were born.

But already the practice of commuting services for payment, and correspondingly of hiring service for wages was becoming widespread; the lot even of the villein was not generally a very hard one. The larger towns were flourishing commercial centres, although being still to a great extent agricultural communities which had purchased rights of self-government and immunity from the jurisdiction of overlords from the king. These rights were conveyed to them by charter. There was already an extensive foreign trade; cloths, wines, and many other European products being imported, while the leading English exports were

wool and hides, and rural products of all kinds.

An incompetent king, Edward II, succeeded Edward I. There was a recrudescence of the struggle between the crown and nobles, who looked upon themselves as the champions of constitutionalism, but were in fact endeavouring to concentrate political power in the hands of a narrow oligarchy. The civil strife, whether latent or active, caused that complete neglect of the Scottish question which enabled Robert Bruce gradually to clear Scotland of the English garrison, and to recover an unqualified independence by inflicting upon the English the decisive defeat of Bannockburn in 1314.

In 1327 Edward II was deposed and murdered by his French wife, Isabella, and her paramour, Roger Mortimer, while the crown was set on the head of Edward III. Three years later the king, then eighteen years of age, effected a *coup d'état* which ended the intolerable government of the regency, and executed Mortimer. All this time Plantagenets had retained possession in France of their hereditary fiefs of Guienne and Gascony, which successive French kings on various pretexts had sought to filch from them. This process was continued by Philip VI. On his accession, a fairly tenable claim to France had been put forward on behalf of Edward of England through his mother, the sister of the last king of France; but France had decided in favour of the Valois succession, and of the principle that there was no right of inheritance to the French crown by or through a female.

The Hundred Years' War

The strife over Guienne and Gascony was a standing cause of quarrel; the claim to the French throne provided another pretext; while a serious subject of contention was the attempt to restrict the valuable trade between England and Flanders which was a fief of the French crown. On account of this the Flemings were ready to take part with Edward if he assumed the character of their lawful suzerain by asserting his claim to the French crown, and on this combination of pretexts the Hundred Years' War between France and England was embarked upon in 1337.

The English longbow and the clothyard shaft had first been brought into effective play by Edward I in his Scottish wars. The Scots and Flemings had recently proved the power of

spearman to defy the shock of the charge of mailed cavalry. The two principles were combined by Edward III and his son, the Black Prince. The English archery and dismounted men-at-arms shattered superior forces at the battles of Crécy (1346) and Poitiers (1356). King Edward captured Calais in 1347, to remain as a gateway to France for 200 years. In 1360 he forced on the French the treaty of Brétigny, which conceded to him a quarter of France in full sovereignty.

Twelve years later all that had been won was practically lost; England retained only a precarious hold upon a part of Guienne and Gascony, as well as Calais. The war was enormously costly, and its costliness developed the power of the Parliament, which was now strong enough to forbid the imposition of taxes, other than those formally sanctioned in the reign of Edward I, except by its own vote. The power of the purse passed definitely into the hands of Parliament, and with it a certain limited control of policy; the royal revenues were insufficient, at least for war programmes, unless supplemented by the land and property taxes, known as tenths and fifteenths, and afterwards as subsidies, which the lords and commons voted.

The Black Death

The general prosperity was checked by the tremendous visitation of the Black Death in 1348. A third of the rural population is said to have perished; for lack of labour the harvest was left to rot and the fields were left untilled, while famine followed upon the plague. The landholders sought to revive all their old powers of enforcing service; the peasantry refused to work except at very high wages, and the government stepped in with the Statute of Labourers, vainly attempting to fix a standard wage. A class animosity was born, quite different from the bygone hostility between the English occupants of the soil and their Norman conquerors. This bore fruit in the peasant revolt of 1381. The revolt was crushed, but was not followed by any enactments for the removal of grievances; the system of villeinage, forced agricultural services, and restrictions upon rural wages remained.

Edward III in the pursuit of revenue had grasped the advantages of encouraging and organizing trade under state supervision. The export of staple goods, wool, hides, etc., was restricted to the Company of the Merchants of the

Staple, trading only in authorised localities, known as the staple towns; the import of manufactured goods was mainly in the hands of foreign trading societies, notably the German Hanse; both groups paid for their privileges and enjoyed powers of regulating the traffic. But at the same time the process of manufacture in England itself advanced greatly, and English cloth goods began to compete in foreign markets as well as in England. Although a gloomy picture of rural life is presented in Langland's *Vision of Piers Plowman*, the pages of Geoffrey Chaucer convey an altogether convincing impression of an England materially prosperous, genial, and light-hearted, and full of a robust kindliness.

Rule of the Lancastrians

Richard II (1377-99) found himself much in the hands of a faction of the nobility, who, however, could no longer usurp the functions now acknowledged to lie in Parliament. Soon after coming of age, he succeeded in recovering the royal authority, but though he ruled well for several years, he was unhappily nursing vindictive schemes and plans of arbitrary rule. He turned suddenly upon the nobles who had once held him in restraint, put some of them to death, banished others, and imagined himself undisputed master of the kingdom. But in 1399 his banished cousin, Henry of Lancaster, returned to England. The discontented nobles rallied to Henry's standard, Richard was deserted and brought a prisoner to London, a parliament was called, Richard was compelled to abdicate, and the parliament declared Henry king of England by lawful descent.

With Henry IV began the rule of the Lancastrian branch of the house of Plantagenet. Raised to the throne of the cousin who was done to death soon afterwards, while yet another cousin, the child Edmund Mortimer, had a better claim than his own to the succession as descending from an elder son of Edward III, Henry knew that he ruled by a parliamentary title. Parliament knew it, too, and the result was that the Lancastrian kings were very much at the mercy of their parliaments. Also, as clerical influences had been vigorously applied on Henry's behalf, the house of Lancaster was compelled to conciliate the clergy. Hence Henry was led to a rigorous suppression of the Lollards. The teaching of Wycliffe, about the end of the reign of Edward III, had attained considerable popularity during the reign of Richard II in a

country where the anti-clerical sentiment was always strong, until it began to be applied as a sort of communistic propaganda; but burning at the stake as the punishment for the unrepentant heretics first became the law of the land in the reign of Henry IV.

That monarch's uneasy rule of fourteen years was followed by the brilliant reign of his son Henry V. In the anarchy which had overtaken the French kingdom, Henry found occasion for a preposterous revival of the claim of Edward III to the French crown. In 1415 he invaded France, captured Harfleur, and at the head of no more than 8,000 men won the victory of Agincourt. Three years later he returned to France and set about a systematic and organized conquest. The factions of French politics brought over to his side the powerful duke of Burgundy and the French queen, when all Normandy was already in his possession. The king of France was compelled to acknowledge Henry as his heir, while the dauphin Charles and the greater part of France remained defiant. Inch by inch Henry made himself master of N. France, but in 1422 he died, leaving the English crown and the French succession to his infant son, Henry VI, and the government of the country to a council of regency.

Loss of Burgundy and Guienne

The resources of England were not equal to a conquest of France. In spite of the abilities of Henry's brother, John, duke of Bedford, the subjugation proceeded slowly, and was stopped altogether by the extraordinary interposition of Joan of Arc. The death of Bedford himself in 1435 was fatal to English ambitions; the defection of Burgundy was still more decisive, and from that time the record of the French war was one of almost continuous defeat; until in 1453 even Guienne was lost, and Calais was the only foothold left to the English in France.

The usurpation of Henry IV and the aggression of Henry V brought their Nemesis. Popular disgust was kindled against the faction who exercised control over the weak, pious Henry VI as being responsible for the disastrous mismanagement of the war and the feeble government at home. The opposition was led by Richard of York, representative of a branch of the descendants of Edward III senior to the house of Lancaster. Richard claimed to be the effective head of the government. The rebellion of Jack Cade in 1450 was not, as is commonly supposed, an

agrarian rising like that of Wat Tyler, but was, primarily at least, a popular protest against the unpopular government. The strife of the factions in high places issued in the War of the Roses.

From 1455 to 1460 war and truce between the parties alternated. It was not until 1460 that Richard startled his own supporters by asserting his own claim to the crown, a claim modified into demand for recognition as the heir, although King Henry had a young son. Richard was killed at the battle of Wakefield, but his son Edward, supported by Warwick, proclaimed himself king, shattered the Lancastrian army at Towton in 1461, and maintained himself on the throne till his death in 1483.

During the first ten years of his reign there were repeated Lancastrian insurrections; the defection of Warwick actually drove Edward IV in flight from the country in 1470; but, returning in the next year, he crushed Warwick and the Lancastrians at the battles of Barnet and Tewkesbury, and for the rest of his reign ruled without fear of any rivals.

On Edward's death his brother, Richard of Gloucester, after an interval of a few weeks usurped the throne of his young nephew Edward V, who was shortly afterwards murdered in the Tower with his brother. The usurper instituted a reign of terror so intolerable that after two years Henry Tudor, earl of Richmond, a descendant of John of Gaunt, though by an illegitimate line, and the acknowledged head of the Lancastrian party, was able to return to England from the exile into which he had retired, to slay Richard III at the battle of Bosworth, and to claim the crown, a title acknowledged by the parliament which he summoned.

The Reign of Henry VII

During 25 years the power of the sword had decided who was to be king in England; parliaments had been summoned, but were attended only by partisans of the dominant faction. Each side had attainted of treason all the leaders on the other side, put them to death when it could lay hands on them, and redistributed their estates. The old families were almost blotted out, and the new generation of nobles bore names which had hardly been heard of fifty years before. It was the business of Henry VII (1485-1509) to restore peaceful and orderly government, commercial prosperity, and reforms, at least of law. The claws of rebellion were clipped and the royal treasury was simultaneously filled by the systematic process of fines

and confiscations, drastically applied wherever an excuse could be found. Parliament was habitually summoned and treated as the king's responsible partner in all his acts.

Foreign policy was directed to the development of commerce and the acquisition of indemnities for campaigns on which nothing had been spent; commerce itself, on the other hand, was applied as a weapon for making the rulers of France and Burgundy compliant. The king ruled always by forms of law; taxation and legislation were the province of parliament, though a skilful king rarely failed to procure from parliament the powers or the money which he required. Rebellions raised on behalf of pretended members of the house of York, Lambert Simnel and Perkin Warbeck, were suppressed. Henry's marriage to Elizabeth of York put the title of his son to the succession beyond question; the marriage of his daughter Margaret to James IV, king of Scotland, in 1503, placed a Stuart on the English throne as the legitimate monarch a hundred years later. When Henry died in 1509 the house of Tudor was firmly established on the English throne, and the crown with a full treasury enjoyed an almost unprecedented power.

The Discovery of America

The reign of Henry VII fell upon that period of transition when the medieval world was passing into the modern. In 1477 the first printing press had been set up in England. The intellectual movement long active in Italy reached England and awakened a new spirit of criticism. Columbus discovered the West Indies, the Cabots from Bristol reached Labrador, the Portuguese sailed across the Indian Ocean to India. Europe was emerging into a new state system. With Henry VII dawns the conception of international relations as being concerned with the preservation of a balance of power among the great states. In the reign of Henry VIII (1509-47) Cardinal Wolsey stands out as the diplomatist who made it his aim to hold the balance between the king of France and the king of Spain, who was at the same time lord of the Netherlands and German emperor—Charles V.

But Henry's international activities were merely an episode. The great feature of the reign was the ecclesiastical revolution which fixed the grip of the state irresistibly upon the church, annexing the greater part of its wealth, and repudiated the authority of the papacy. The instrument of

the revolution, the artificer who designed its methods, was Thomas Cromwell, who, after Wolsey's fall in 1529, won Henry's confidence and retained it till 1540, when he had completed the work, not only of subordinating the church to the crown, but of obtaining for the crown by strictly legal parliamentary process such a latitude of power as it had never before possessed.

Edward VI and Mary

When Henry initiated the ecclesiastical revolution with the primary object of getting rid of his wife in order to marry another, he took the nation into partnership and secured parliamentary sanction for everything he did. He, however, procured from it first a weapon for silencing all external opposition in the Treasons Act of 1534, and then a virtually absolute authority for himself, though not for his successors, by the Royal Proclamations Act of 1539. Henry left one young son, whose legitimacy was indisputable, and two older daughters by mothers whose marriages with him had both been pronounced invalid, though before his death it had been formally laid down that the right of succession remained to both children.

While Edward VI was king (1547-53) the government was in the hands of a council controlled first by Edward's uncle, the protector Somerset, and then by John Dudley, earl of Warwick, best known as duke of Northumberland.

Henry's extravagance had depleted the treasury; he had suppressed the monasteries, the only institutions in the country which were officially concerned with the relief of poverty. For more than half a century the peasantry had been ousted from the land, and distress and suffering were widespread.

Both Somerset and Northumberland, from conviction or from policy, actively fostered the religious reformation, and carried out the protestantising of the Church with gross and unseemly violence, though without extreme persecution. The accession, however, of Mary in 1553 was followed by an extreme reaction with the sanction of parliament—under which some 300 persons, including five bishops, were burnt at the stake. The effect of the persecution was not the suppression of heresy, but the development in the popular mind of an intense hostility to Romanism. The general impoverishment and the miserable misgovernment during the two reigns of Edward VI and Mary brought England to such low estate that she was unable to

retain her hold upon Calais, which was retaken by the French in 1558, leaving her without a footing on the Continent for the first time since 1066.

Elizabeth in 1558 found the country in evil case indeed, but with all the elements for a glorious recuperation. An unfailing judgement in the selection of counsellors and instruments, a supreme confidence in the spirit of the nation with which she identified herself, a complete freedom from conscientious scruples, an intuitive perception of the weaknesses of her enemies, a perfect mastery of stage effects, united with an indomitable determination to raise England to the position of the first power in the world, made her the most brilliantly successful of all English monarchs. The national finances were reorganized with a rigid economy which ensured full value for every penny spent.

The question of religion was taken in hand, on the principle of permitting the widest possible latitude of opinion compatible with uniformity in practice, while explicitly requiring the subordination of all authority to that of the state, and rejecting any compromise which implicitly attributed authority to the pope. The enterprise of the seamen who set at naught the Spanish claims to a monopoly of the New World was unofficially encouraged. Nearly thirty years passed before that open rupture with Spain came, but by that time England was ready, and there came the annihilation of the Spanish Armada, in the fight of July 20–August 2, 1588.

Period of General Prosperity

A regular government, pursuing a popular policy with conspicuous success and with increasing stability, free from every kind of unsettling capriciousness, encouraged energy and enterprise in every direction. The regulation of trading and apprenticeship, the multiplication of chartered mercantile companies, the gradual readjustment of the rural population to the agrarian upheaval of the first half of the century, and the judicious experiments which culminated in the poor law of 1601, established a general prosperity. The queen ruled, but always with the express assent of her people.

Elizabeth was the last of the offspring of Henry VIII. She was succeeded therefore by the legitimate heir, James VI of Scotland, the great-grandson of Henry's elder sister Margaret. James I (1603–25) came to the throne of England with a title less disputable than that of any monarch since Richard II,

except Henry VIII and Edward VI. By the peculiar cunning which he called kingcraft, he had already acquired for the crown in Scotland a control over the government enjoyed by none of his ancestors since Robert Bruce. James claimed and sometimes tried to exercise the power of overriding the law by divine right; but a wholesome fear of arbitrament by battle always kept him from overstepping the limits of English endurance. He wrought the country up to a high pitch of irritation, destroying utterly the basis of mutual goodwill between the crown and the people, which had in fact been the basis of the apparently despotic authority of the Tudors.

Charles's Struggle with Parliament

Charles I (1625–49) reaped the bitter fruits of his father's theories. Elizabeth's parliaments loved her and bore with her caprices. The parliaments of the Stuarts did not love them at all, and were only too ready to discover grounds for quarrelling with the monarch. Charles gave them ground enough by entrusting the direction of policy to his favourite, George Villiers, duke of Buckingham, by standing on what he regarded as his legal rights of raising revenue without sanction of parliament, by overriding the law in the punishment of recalcitrants, and by repressing all latitude of religious doctrine and observance; enforcing his will through the arbitrary powers of the courts of Star Chamber and High Commission.

Charles's parliament, on the other hand, refused supplies until grievances should be removed, asserted the novel claim to a right to the control of religious affairs, and in 1628 compelled the king to accept the Petition of Right, which unfortunately failed of its precise purpose—the accurate definition of the limits of the royal prerogative. Eleven years of arbitrary rule without parliament were ended in 1640 by the arming of Scotland—an independent kingdom to whose king accident had also given the crown of the neighbouring kingdom of England. Scotland found the king's rule too arbitrary; the king could not suppress his Scottish subjects without the aid of English arms; all his expedients had not provided him with the money for an army, and he was obliged to summon the English parliament, and then to dissolve it, and summon it anew.

The Long Parliament, instead of aiding him against the Scots, attainted and beheaded Strafford, impeached Laud, and proceeded to force the king to accept a

series of enactments abolishing the arbitrary courts, and explicitly depriving him of the disputed prerogatives. A *coup d'état*, the attempted arrest of five members on Jan. 4, 1642, failed completely; the king left London, and after several months of futile negotiation, the great Civil War opened in August, 1642.

The struggle was conducted with a decency and humanity which offer a pleasing contrast to the horrors of the Thirty Years' War, then raging on the Continent. After various vicissitudes, the army of the parliament was reorganized by Oliver Cromwell and won the decisive victory of Naseby on June 14, 1645. Charles surrendered to the Scots, who had associated themselves with the cause of parliament, in May, 1646, was by them handed over to the parliament in Feb., 1647, and was carried off into the custody of the army on June 3. From his confinement he intrigued with his own supporters and negotiated with three separate groups—the chiefs of the parliament, the chiefs of the army, and the Scots—each of whom now had different objects in view. The king's attempt to recover his ascendancy by playing them off against each other failed disastrously. His own attempt to escape to France in November, cavalier insurrections, and a Scots invasion in 1648, threw the control into the hands of the victorious army, and determined its chiefs that the king's death was the necessary condition for the restoration of a stable government. An arbitrary court condemned him to death and he was executed on Jan. 30, 1649.

The Commonwealth

England was now proclaimed a commonwealth or republic. The Scots recalled the prince who was *de jure* Charles II, but the English Commonwealth could not afford to have the claimant to the throne of England seated on the throne of Scotland. A war with the Scots followed and culminated in Cromwell's crowning victory at Worcester (Sept. 3, 1651), but Charles II made his escape from the country. The remnant or rump of the parliament, which had constituted itself the sovereign body by its own authority, sought to transform itself into a permanent oligarchy, with the result that it was forcibly ejected by Cromwell in April, 1653; and from that time Cromwell, who was made lord protector by the army in December, was virtually the absolute ruler of England. The former champion of parliamentary government found all attempts to work in harmony with the

parliament vain. His government was necessarily arbitrary, but strove at least to be as just as the circumstances permitted, while his vigorous imperial policy, though it helped to raise France to a dangerous height of power, made England feared on the Continent as never before. With Cromwell's death (1658) came chaos. The country was sick of the rule of soldiers and saints, and it was with practically unanimous satisfaction that Charles II was recalled to the throne (1660).

The Restoration meant nothing at all like the triumph of the Stuart conception of monarchy. The country intended parliament to be predominant, and, as far as concerned legislation and taxation, the king found that it was to be neither cajoled nor overridden. But parliament, rendered by the arbitrary Puritan rule of the Commonwealth intensely hostile to Puritanism, which it smote in a series of enactments much more repressive than was at all pleasing to the king, proved no less hostile to Romanism, to the surprise and disappointment of Charles.

Under the mask of frivolity and dissipation, Charles concealed an invincible determination to avoid fighting with parliament but to make himself entirely independent of it by secretly selling himself and the country to the king of France. For 25 years he successfully deceived statesmen, courtiers, politicians, English and foreign, and the king of France himself. On March 28, 1681, with Louis XIV's purchase money in his pocket, he dissolved his last parliament at the moment when its leaders imagined that he was fast in their grip. He had built up a standing army sufficient for his purposes; in the next three years he cancelled and renewed the charters of the boroughs in such a manner that the crown had practically absolute control over their parliamentary elections.

Having no legitimate children, he had secured the succession to his Roman Catholic brother James. His death left James II with all the master cards had he but known how to play them skilfully. James did not. The loyalty of the country was turned first into uneasiness and then into grim hostility. When, for the advancement of Romanism, he alienated ardent royalists and fervent churchmen by arbitrarily suspending or overriding the law, men of every party joined in calling to their aid his son-in-law, William of Orange. William landed in Tor

Bay on Nov. 5, 1688. James took to flight, and on Feb. 13, 1689, William and Mary were proclaimed king and queen of England, having accepted the Declaration of Right which laid down what were to be in future the fundamental limitations of the power of the crown—limitations put forward as the historic right of the people. Scotland followed suit and the crowns remained united.

The accession of the stadtholder of Holland, the lifelong enemy of Louis XIV, carried England full into the vortex of international politics. The ascendancy of the English navy, long disputed by Holland, and now for a moment challenged by France, was decisively established and was never again lost save for a moment in 1782. The right of parliament to fix the course of the succession to the throne was established; the state system of finance was reconstructed by the creation of the national debt and the Bank of England. The party system inaugurated by Shaftesbury under Charles II developed steadily. William died on March 8, 1702, at the moment when he had organized the Grand Alliance which was plunging England into the War of the Spanish Succession. He was succeeded by Anne, second daughter of James II, under whom that war was fought out to its issue. But another issue had arisen. Scotland demanded a permanent union with England, upon terms agreeable to herself, threatening in the alternative to name for Scotland another successor to the throne than that of England. On May 1, 1707, the Act of Union came into effect and the history of England as a sovereign state merged into the history of the United Kingdom (*q.v.*).

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Englefield. Parish and village of Berkshire, England, $5\frac{1}{2}$ m. W.S.W. of Reading. Here Alfred defeated the Danes in 870.

Englefield Green is a residential district in Surrey, $1\frac{1}{2}$ m. N.W. of Egham at the S. of Cooper's Hill. The cottage on the green was the home of George IV's mistress, Mary Robinson, the actress.

English Bazar OR ANGRAZABAD. Town of W. Bengal, India, in the Malda district. It stands on the right bank of the Mahananda river, 56 m. N. of Murshidabad. The East India Company established a silk factory here, and there were also Dutch and French settlements. The chief trade now is in grain. Pop. (1951) 30,663.

English Channel. Stretch of water separating the S. shore of England from the N. coast of France. It communicates with the North Sea on the E. and the Atlantic Ocean on the W. Its extreme length from the Strait of Dover to a line drawn between Ushant, in France, and Land's End, in Cornwall, is 280 m. Its width from Dover to Cape Gris-Nez is 17 m., from Land's End to Ushant 110 m. Its widest part is between St. Malo and Lyme Regis, a distance of 145 m. Its maximum depth is 70, its average depth 30 fathoms. In the Strait of Dover is a chalk ridge at a depth of 12 fathoms. The bed of the channel is of coarse gravel. England has a coast line of 392 m., while the French seaboard is 574 m. Many rivers discharge their waters into the Channel, notably the Seine. The chief islands are the Isle of Wight and the Channel Islands. Fishing is carried on, particularly for mackerel and pilchard. See Channel Swimming; Channel Tunnel.

English Horn. Double-reed wind instrument of the hautboy family. See Cor Anglais.

ENGLISH LANGUAGE AND LITERATURE

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The first part of this article describes the origins, history, and form of the English language. The second briefly surveys the chief writers, and their relative position, in English literature. It may be supplemented by the articles on Poetry; Biography; the Novel, etc.; and by the many shorter articles on other authors, e.g. Sir Henry Newbolt; Gordon Craig; Julian Grenfell; Frances Trollope; P. Wyndham Lewis

The earliest form of English—from the beginning to about one hundred years after the Norman Conquest—is sometimes called Anglo-Saxon, but nowadays more generally simply Old English. The people who lived in the oldest period called themselves *Angelcynn*, and their language *Englisc* in the vernacular, or, in Latin, generally *Angli*, sometimes *Angli sive Saxones*, and *Sermo Anglicus* or *Lingua Saxonica*. These terms are applied to all the tribes and to all the dialects.

Old English is shown by its vocabulary and its system of inflexions to be a W. Germanic language, closely akin to Old Frisian and Old Saxon, and still closely, though more remotely, to the High German dialects. The resemblances between Old English and Old Frisian are indeed so great and numerous that some regard these two groups of dialects as forming a special branch of W. Germanic speech subsequently differentiated into English and Frisian which they call the Anglo-Frisian branch. From the earliest records three main dialect types in Old English, corresponding to tribal divisions, may be distinguished: the Anglian dialects, i.e. Northumbrian and Mercian; the Saxon dialect; and the Kentish, spoken by the Jutes. The differences between these are comparatively slight, so far as they can be traced in the records, but the subsequent history of the several types is very different. The Angles settled in the N. and Midlands, the Saxons in the S. and S.W., and the Jutes in Kent, the Isle of Wight, and parts of Hampshire.

The Old English Alphabet

The English, in common with other Germanic tribes, possessed an angular-shaped alphabet suitable for cutting or scratching upon metal, bone, and other hard substances. This is known as the Runic Alphabet, and the letters are called runes. A few inscriptions in this form survive on stones and whalebone, but probably none are much older than the oldest written documents of the ordinary kind. After the introduction of Christianity, the English learnt the art of writing from Irish monks, and the ordinary Old English alphabet is almost identical with that in which Old Irish was written. It was soon found convenient, however, to

borrow from the Runic alphabet two symbols to express characteristically English sounds—*þ* called “thorn” for *th*, and *ƿ* called “wen” for *w*. In modern editions of Old English works it is now unusual to reproduce the shapes of the MS. letters, which are printed in ordinary type except *þ* and *ð* which also stands for *th*; the vowel symbol *æ*, for the vowel sound in Modern *hat*; and occasionally *ȝ* the Old English form of *g*. The spelling of Old English, allowing for certain inconsistencies, is on the whole phonetic.

Sound Changes and Dialect

Perhaps the most important aspect of the evolution of language is the change in pronunciation which continuously proceeds. Sound changes have a far-reaching effect upon the history of every language and bring much else in their train. Not only does sound change alter the whole external aspect and character of a language, so that by this means chiefly, or alone, dialect is often differentiated from dialect, and language from language, but sound change involves the alteration, or it may be the destruction, of inflexional suffixes, whereby the main features of accidence are modified or swept away, and these losses of significant endings may, and often do, bring about a revolution in the syntax of the language.

It is now recognized that sound changes are regular in their effects, and that they take place, within a given period and in a given language, according to definite principles and conditions. Within the above-mentioned limitations of time and language and phonetic conditions the same sound will always change in the same way or direction. By the side of regular sound change, the principle of linguistic analogy, or the close association of form with form, whereby one is modified by the other, without normal phonetic development, is recognized as of hardly inferior importance to the action of phonetic laws. It must be remembered that language cannot exist apart from living human beings who speak it, and that change in language implies a change in the physical and mental habits of the speakers.

THE HISTORY OF ENGLISH. The history of English may be said to

have begun from the moment when the group of dialects known as Old English had become differentiated from the parent W. Germanic stock. At the moment of its earliest appearance in a written record, Old English had already undergone a number of characteristic changes which separate it from the nearest cognate languages. Under the conditions of complete geographical separation from the speakers of the other W. Germanic languages of the Continent, English underwent still further independent changes.

While alterations in the consonant changes were comparatively slight, those involving the vowels were considerable. There are two main classes of sound changes: *Isolative*, which arise in the sound of a language in the course of its history, without any discoverable reason, and without any influence exerted by the neighbouring sound in the word or sentence; and *Combinaive*, which result from the influence of one or more sounds in the word, or sentence, upon another sound, or from the effect of the position of the accent or stress in native words, upon the root syllable, not upon the prefix or suffix. In English, unstressed syllables have always been very liable to weakening, and are often eliminated altogether.

The Old English vocabulary is of a characteristic W. Germanic nature, and the great bulk of words are of this origin. There is, however, a considerable element of Latin loan-words: (a) those borrowed during the Continental period, e.g. *straet* “street,” Lat. *strāta via*, paved way; (b) those borrowed from Latin-speaking Britons in this country, such as *ceaster*, town, Lat. *castra*, camp; (c) those borrowed from Roman ecclesiastical sources, e.g. *pāpa*, pope.

Effect of Spoken Latin

Latin must have been freely spoken among the upper classes of the Britons, and in the larger towns of Britain. Several Latin words which expressed ideas for which no equivalent existed in Old English were literally translated, such as *welwillend* for *benevolens*. It has been suggested that, if the English invasion had not taken place, the chief language of the country would not be a form of Welsh, but more probably a neo-Latin, or Romance language. Celtic exerted

only a small influence upon the vocabulary in the Old English period, except in the names of hills, rivers, and other geographical features, which retained their old designations—*pen, avon, cumb, dūn*, etc. The Scandinavian influence, which began in the 8th century, shows very slight traces in the written documents before the 11th, by which time the English and the Danes in certain districts had amalgamated, and having passed through a bi-lingual stage, had settled down together, with English as the surviving language in a form which retained many elements of the language of the once hostile settlers.

With the rise of Wessex to the ruling political position among the Old English states, the literary labours of King Alfred made the dialect of this province the chief vehicle of literature. All the works of literary importance, both poetry and prose, which have survived, are written in a form of West Saxon, occasionally with traces of other dialects. This form of English may be regarded as a common literary standard for the whole country from the beginning of the 10th century.

From Old to Middle English

The Conquest had at first little effect upon the spoken language. Few Englishmen learnt French for several centuries, and they could not borrow words from a language which they did not know; nor was there any reason why the presence of foreigners ignorant of the native tongue of the country should in any way affect its pronunciation and inflexions. The changes made apparent by the spelling in the middle of the 12th century are not the result of the Norman Conquest, but the normal development of tendencies which were active before the Normans came. The rather abrupt contrast observable in the language of documents from about 1150 onwards does not represent any sudden new development, but implies that the old literary tradition, which largely concealed the facts of speech by means of an antiquated convention, has almost passed away, and that a new literary convention, and to some extent a new scribal mode of spelling, have begun which are nearer to the language of everyday life than was the older tradition.

The language of the last part of the Laud, or Peterborough Chronicle, written soon after 1157, is still in a sense Old English, but many changes are observable. The highly inflected Old English definite article has to a great extent given way to an uninflected form, *þe*,

"the," which never varies, but takes prepositions before it to express case-relations which Old English expressed by inflexion. Such constructions as *þe wreece men of þe land* "the wretched men of the country," *betwyx þe kinges freond and þe earles freond* "between the king's friends and the earl's friends," sound strangely modern. Already in the latter part of this Chronicle the unstressed vowels are fairly regularly written *e*, as in the later Middle English period, to represent Old English *o, a, u* and *e*. The Norman scribes have taught the Englishman the useful graphic distinction between *f* and *v*, whereas the latter formerly wrote *f* for both sounds. The Old English accusative singular of the third personal pronoun masculine, *hine*, has already been lost in favour of the dative *him*, as at present, the feminine pronoun *scæ*, the ancestor of *she*, first appears instead of the old *hēo*.

The present-day use of a preposition at the end of a sentence occurs—*me lihtede candles to æten by* "men lighted candles to eat by." The case-endings of adjectives are largely lost. Although most of the typical Middle English changes in the vowels are not yet consistently expressed in the spelling, there appears an uncertainty and a tentative groping after the best way of expressing a pronunciation which is evidently changing. As regards vocabulary, a few French words are used, all more or less technical, expressing new and foreign conceptions or institutions, offices or titles—*canceler, prisun, cuntesse, emperice*. The only word which might be considered non-technical and belonging to everyday life is *païs*, "peace." A few new Scandinavian words are used: *tōc* "took," and *oc* "and." The usual English words *niman* "take" and *and* are also used.

The Middle English Period

This may be held to begin about 1200. The process of change is more rapid in the dialects of the N. and those of the E. Midland than in those of the S. and of the S.W. Midland. In the N. especially the loss and confusion of flexional endings has gone very far by the beginning of the 14th century. A characteristic of the Middle English period is the great dialectal variety which finds expression in the written documents. The main types are the N., which includes the dialect of S. Scotland; the E. Midland; the W. Midland; the S.W. Midland, including the dialects of Herefordshire, Worcestershire, Oxfordshire, and Shropshire; the S. dialect, including all types as far

E. as Surrey; the S.E., including the speech of Kent and Essex. The London dialect, which in its earliest forms shows a mixture of purely S. with Kentish or S. Eastern forms, becomes increasingly important from the first quarter of the 14th century onwards.

The London Dialect

Early in the 14th century the London dialect is still largely pure S. in type, that of Surrey and Middlesex, but shows certain Kentish or S.E. features, and a slight tinge of E. Midland. By the end of the century, Chaucer and those of his contemporaries who write in this dialect show an increasing number of purely E. Midland features, rather strong S.E. influence, and a certain survival of S. characters. Chaucer is fairly representative of the best London and court English of his day. Owing to the political and commercial importance of the capital, the type of English there spoken was naturally bound to become the leading variety in the country, and the prestige of Chaucer and the popularity of his writings led to many imitations, not only of his style but of his dialect, even among writers who did not speak London English.

Nevertheless, for the most part, throughout the 14th century, people continued to write in the dialect which they spoke. The beginnings of a change may be seen when Chaucer's contemporary, Gower, writes, not in the Kentish dialect which was naturally his own, but in a close approximation to that of London, with but few provincialisms to betray his native dialect. The Middle English period may be said to close with the death of Chaucer, or in the first quarter of the 15th century, and soon after that date there are no more literary works written in pure provincial dialect, except in Scotland, which had a standard of its own, so that the history of English centres more and more round that one form which has become the universal standard. But while the London type predominates increasingly in written documents of all kinds, from whatever area, there are plenty of traces, far into the 15th century, of the provincialisms of the writer's native speech.

The vocabulary of Chaucer is very largely our own. He uses Norman French words, not here and there, like early Middle English writers, but as indispensable elements of his style. Norman French words are no longer foreign, but hundreds have penetrated into the very fibre of English speech, and it is not very easy to write many consecutive sentences not containing words of

this origin. Norman French having been the language of the upper classes for nearly 300 years, and the official vehicle of law and government, was abolished in courts of law in favour of English in 1362; in 1385 it was no longer used in schools; by the end of the century it was probably dead as a spoken language. The Scandinavian element is very large in Middle English in the N. and E. Midland dialects.

Modern English

The chief event in the general history of English since the beginning of the 15th century has been the gradual acceptance of a virtually uniform dialect by all writers. This agreement was greatly helped by the introduction of printing in 1477. Caxton, himself a Kentishman, adopted the London dialect for his translations and prefaces, and a knowledge of this type was rapidly diffused throughout the country through his labours. Even in the mid-15th cent. provincial or regional dialect was falling into disuse in writing.

The adoption of a standard of spoken English was a much slower process. George Puttenham, in his *Art of English Poesie* (1589), says that in the N. noblemen and gentlemen spoke their own dialect; Aubrey has it from one who knew Sir Walter Raleigh that he spoke broad Devonshire all his life. In the 17th century comedies country gentlemen who come to London for the first time are made to speak a broad rustic form of English, and as late as the 18th century Fielding makes Squire Western speak pure Somersetshire. It was the language of the court which in Elizabeth's day was recognized as the best form of spoken English, and upon this the literary English of the day, the ancestor of our own, was based. The English of Caxton is virtually the descendant of that of Chaucer. The differences between the two are due chiefly to the growing encroachment of the E. Midland element in London English since Chaucer's time.

Since the Middle English period English pronunciation has changed considerably, although the conventional spelling handed on, with few modifications of importance, from the early printers who derived it from the professional Middle English scribes, reveals next to nothing of this. All the long vowels and all the Middle English diphthongs have altered completely in character. Many changes in the pronunciation of consonants have also taken place, though some of these have since been

"restored" through the influence of the received spelling. The same factor has influenced to some extent the pronunciation of unstressed vowels which in the Early Modern period had undergone considerable weakening.

It is a necessary result of the recognition of a standard dialect, which in origin was that of the upper classes, that other forms fall into disrepute, and are considered either vulgar or merely provincial and rustic. The latter epithets are now applied to the modern regional dialects, while the former justly applies to certain forms of English, cognate with the best form of spoken English in origin, but differentiated from it in the mouths of the humbler and less refined classes of society. The principal sound changes were probably complete, or at least well under way, by the end of the 16th century, though the final distribution of the various dialect types which compose standard English was not yet finally settled. The subsequent history of standard spoken English is very largely the result of the influence exerted upon this by other class dialects, and to some small extent by regional or provincial dialects.

Modern English Sound Changes

The changes made in the English vowel system from the "Continental values" to approximately our present pronunciation are traceable from occasional spellings of the scribes, in some cases as early as the early 14th century, very clearly and frequently in the 15th century, when private letter writing began to be practised by all sorts of persons, and in the 16th and later periods, not only from this source, but also from deliberate descriptions of English pronunciation. Most of the typical modern vowel changes began very early, but acceptance of many of these in court English was considerably later than the 15th century, and some appear to have been accepted only in a few words. Many of them were considered vulgarisms at first, and penetrated into the standard language through the influence of lower class London English. Many pronunciations used by the best speakers during the 17th and 18th centuries would now appear vulgar, rustic, or, at least, antiquated. Among these may be mentioned *sarvis*, *sarvant*, *sarmon*, *varlue*, *Booshop*, *goold*.

There is ample evidence from the 15th century onwards that the present day natural pronunciation of the vowels in unstressed syllables either with the "murmur vowel" (ə) as in second syllable of *father*,

or with *i* was already in vogue. In the 18th century words with *on* were often pronounced as with *in*, e.g. *flaggin*, *dunjin*, *sturjin* for *flaggon*, *dungeon*, *sturgeon*, etc. The ending *ure* was pronounced like *-er* far into the 18th century—*jointer*, *picter*, *nater*, etc. Such a word as *fellow* was pronounced *feller* (without *r*), and Pope rhymes it with *prunella*. The present-day pronunciation of the suffix *-es*, *-est*, *-eth*, etc., as *-iz*, *-ist*, is already established as the polite one in the court English of the 15th and 16th centuries by such spellings as *horsis*, *princis*, *eldist*, *givith*, etc.

Spelling Pronunciation

In the 18th century *nus*, *pus*, *Usly*, *thusty* are the spellings of a writer on pronunciation to express the proper forms of *nurse*, *purse*, *Ursula*, *thirsty*. The ending *-ing* was pronounced as *-in* as early as the 15th century, and this was probably universal in standard English until the end of the first quarter of the 19th century, when the spelling pronunciation won the day to some extent. Usage now varies. The loss of the sound of *gh* in the middle of words before *t* is shown to have been caused in the 15th century by the omission of the symbol in words where it belongs historically, and by such spellings as *dought* "doubt," *ought* "out," *wright* "write." In the 16th century even Spenser often writes *whight*, *quight*, etc. The sound of *w* develops initially before *o* and *ho*; *won* for *one* is fairly common in the 15th century, and in the 16th occurs in the letters both of Henry VIII and Elizabeth. The spelling *whole* has been retained. Consonants are often lost, finally and in combinations, as is proved by spellings from the 15th century onwards.

Similar pronunciations are recorded in the 18th century. The following 15th and 16th century spellings show losses in combinations in the middle of words: *Whysson weke* "Whitsun"; *Wensday*, *morgage*, *sepukyr*, *Wostreet* "Wood Street." Queen Elizabeth herself writes "often" *offen*. *Lunnon* was a polite 18th century pronunciation. Many of these forms survive at the present time, but the consonants are now often restored from the spelling. At the beginning of unstressed syllables *w* was normally dropped already in Middle English. It has been largely restored, however, through the influence of the spelling. While *w* is still omitted in *Norwich*, *Southwark*, etc., it has been restored in *forward*, earlier *forrard*, *Edward*, etc. *Eddurd* was the polite 18th century pronunciation, and

survived among old-fashioned speakers far into the 19th.

Weak plurals are more frequent among good writers in Early Modern English than now, *e.g.* *housen, shoon, eyen, All Soulen, peasen*. The old feminine possessive without *-s* is found commonly as late as the 16th century—*Our Lady Mary Grace, the Queen Grace*, etc. These survive now in *Lady Chapel, Lady Day*. The personal pronouns *her* (possessive) and *hem* (dative plural) are frequently used in the 15th century by the side of *their, them*. The former is apparently not found after the early 16th century; the latter is rare in the 16th and early 17th, but reappears in the 18th century as *'em*. "Group inflexion" in the possessive of nouns is found as early as the 15th century—the *erle of Wiltones wyf*—by the side of the older construction, *the dukys daughter of Northfolke*. Such constructions as *for Jesus Christ His sake* are very common in the 15th and 16th centuries, the pronoun being often detached and written *is*, and sometimes joined to the preceding noun as a possessive suffix, which it originally was.

The old Southern present plurals of verbs in *-eth* linger on in occasional literary and colloquial use far into the 16th century, though the form without ending is far commoner. In the 15th century the forms in *-en, -in* are still often used. The third person present singular ends in *-eth, -ith, or -th* during the whole of the 15th and 16th centuries in the best English. The forms in *-s* come in gradually, at first chiefly used either in poetry for the sake of rhyme or metre, or in fairly colloquial style. They are by no means universal by the end of the 16th century. *Hath* and *doth* survive far into the 18th century in both colloquial and literary use. Pope uses *was* after *you*, when one person only is addressed. This practice survived in good colloquial use into the 19th century.

Shifting Standards of Correctness

A careful study of the history of English from the earliest times, based on intelligent interpretation of the written records of the successive ages, leaves an impression of continuity amid perpetual change. The history of standard English during the last 500 years has been largely one of the varying distribution of elements drawn first from regional and later from social dialects. The standards of what is polite and correct shift from age to age. What is vulgar in one generation becomes the

pattern of propriety in the next; that which was elegant and habitual to the most refined speakers is felt to be slipshod or worse. Since the early 19th century there has been a great striving after "correctness" in English speech. Our speech today is far less untrammelled in its colloquial forms than that of the 17th and 18th centuries. Good speakers then seem to have been content to follow the natural tendencies of unstudied utterance, and were less anxious for "correctness" as this was later understood. This process is still going on and, with the increased diffusion of education among those who have no traditional knowledge of the best speech, bids fair to alter our language out of all recognition.

Assimilation of Idiom and Jargon

From three main sources, obvious especially in colloquial speech but also in writing, come the contributions of the 20th century to the growth of English vocabulary. The influence of the cinema has added a deposit of American words and idioms, several of them new inventions, but many, *e.g.* *crack* for witticism, recrossing the Atlantic to the land in which they were current centuries ago. There is a tendency to apply semi-technical terms from the sciences, like *complex* and *allergic*, or from warfare like the nouns *drive* and *front*, in metaphorical and often inappropriate contexts. Old boundaries between parts of speech are broken down by turning nouns into verbs (*telephone, contact*) or into adjectives (*railway journey, control board*). If it be claimed that these tendencies enrich the language and make it more responsive to the subtleties of expression needed in a world of specialists, there is also the result that layers of jargon are spread over the pattern of what used to be regarded as lucid English. But a language already so indebted to foreign tongues can know no logical ban upon further borrowing. The best hope is that the more tawdry pieces of the new coinage will not be allowed to continue in circulation.

It is impossible to foretell the future of English, though we may well believe that it will be no meaner or less splendid than its past. New standards of speech will in all probability arise with the growth of new centres of culture in this country, and still more in the dominions, whose populations are still "mewing their mighty youth," and future historians of spoken English will have to take into account the many

varieties of our mother tongue, spoken by peoples of different experiences and modes of life.

H. C. K. WYLD

LITERATURE. Old English literature began with poems like *Beowulf* and *Widsith*, written on a rhythmical system in which alliteration and assonance play the chief parts. Though the product of a rough age, it is virile and full of colour, and shows qualities of character that have come to be associated with the English people down the years.

The early prose is all in Latin (which was to remain the *lingua franca* of the learned for a thousand years); but King Alfred (reigned 871–901) rendered Bede, Orosius, Boetius, and others into the vernacular, and thereby became "the father of English prose."

But the main stream of English literature was to be commingled with that of France, so that when at last in the 14th century English came into its own, it had become the rich composite speech, in vocabulary and syntax, which was to be the medium of English poets from Chaucer onwards. Meanwhile English poets gradually assimilated the syllabic, accentual metre which had been first heard in the Latin hymns of the Church and Provençal and French song.

By the 12th and 13th centuries the French poets of Provence and Gascony, of France proper, and of England, had created the romantic and lyric literature which is the fountain-head of all later European literature. The new love-poetry of Provence, with its courtly and ideal, but also conventional, cult of love, the romances of Charlemagne, of Arthur and his knights, of Troy, Thebes, and Alexander, beast-epic and allegory and fabliau—these were made by the French familiar to every country of Western Europe and reproduced in other tongues. When English literature began to awaken again, it was in the reproduction of French themes and forms.

After the Conquest, the first English poem which is really a work of literature, Layamon's *Brut*, is a long and interesting elaboration of that legendary history of Britain, from Brutus to Arthur, which had first taken the shape of history in the *Historia Regum Britanniae* of Geoffrey of Monmouth, and had been already cast into verse by the Norman poet Wace. But Layamon makes interesting additions from Welsh oral tradition. The verse is apparently intended to follow the

Old English model, but is rapidly approximating to an English reproduction of the French octosyllabic or four foot verse, the long line falling into two parts. Even in religious and didactic works of no great literary merit, the *Ormulum*, the *Bestiary*, etc., the interaction of old English form and feeling with the new influences can be observed; but the full effect of French inspiration in the begetting of a new literature, fresh in spirit and in form, is seen in the lyrics and the romances of the 13th and early 14th centuries.

Early Lyrics and Romances

The earliest English lyrics, songs like *Sumer is i-cumen in*, *Lenten is come with love to town*, and *Alisoun*, are already in a tongue quite easily recognizable as English. They are the work of poets familiar with the French lyric, its rhythms and its tone, gayer than that of Old English poetry. They blend in humorous fashion lines English, French, and Latin. The same is true of the first English romances, all probably translations, even when, as in *King Horn*, *Havelok the Dane*, *Richard Cœur de Lion*, *Bevis of Hampton*, and *Guy of Warwick*, they deal with native legendary themes. And all the varieties of French romance are represented.

All lack the courtly tone of French romance, being composed for popular audiences who love a genially told story of adventure rather than refinement of sentiment. In their diction there is a shaking together of the elements, English, French, and Scandinavian, which make up the rich tongue of Shakespeare and Milton; while in the metrical, not alliterative, poems, can be traced the process by which the syllabic rhythm of French verse was adjusted to the idiosyncrasies of stress and cadence in English pronunciation. Outside romance and lyric, poetry of the 13th and early 14th centuries is didactic—the *Cursor Mundi*, a long paraphrase of Scripture history and Church legend; the *Pricke of Conscience*, a summary of theology, erroneously attributed to Richard Rolle of Hampole, a writer of mystical works in Latin and English prose; Robert of Gloucester's verse histories; and other works.

In the 14th century English triumphed over French, even at court; an English poetry appears that is artistically on a level with the best of France and Italy. The movement to raise the artistic level of poetry took two directions. One

was an artificial and abortive attempt to revive and elaborate, with or without the addition of rhyme, the old alliterative verse—a movement which produced the finest of the English romances, *Gawain and the Green Knight*; the beautiful elegiac and symbolic poem, *The Pearl*; and the interesting, if inchoate, satirical, didactic, and mystical poem called *The Vision of Piers Plowman*, attributed to William Langland.

But the future of English poetry lay with those who completed the naturalisation of French poetry, its regular metre, its refined and courtly spirit, its grace and elegance of style. John Gower, after experimenting in a satirical Latin poem, and a tedious didactic poem in French, composed at the close of his life a long poem in English, *Confessio Amantis*, in which he sets in the framework of the confession of a lover to Genius, the priest of Love, a series of stories drawn from many medieval and classical sources and narrated in equable, well-turned octosyllabic couplets.

Spirit of Chaucer's Poetry

Geoffrey Chaucer did more than this. Brought up at court, and sent in later years on missions to various lands, including Italy, Chaucer was educated in the tradition of contemporary French poetry. His earliest poem, *The Book of the Duchess*, is an elegant but jejune dream allegory, a love poem whose incidents are represented as happening in a dream, the characters being personified abstractions. But the majority of Chaucer's extant poems were written after he had made acquaintance with the Italian poetry of Dante, Petrarch, and Boccaccio.

The *House of Fame*, an incomplete, ironical allegory, shows the influence of Dante in style and incident. The *Parliament of Fowls* enriched its decorative fabric with borrowings from Boccaccio. Chaucer's first and greatest dramatic story, *Troilus and Criseyde*, is based on Boccaccio's *Filostrato* with an incident from the *Teseide*. The *Teseide* itself is the source of the chivalrous story of Palamon and Arcite which became the *Knight's Tale* in *The Canterbury Tales*. The stories collected in the *Legend of Good Women* are drawn from Ovid and from a couple of Latin works by Boccaccio. The charming Prologue to the poem is Chaucer's own.

But much as Chaucer learned from Italy, the more serious and idealistic spirit of Dante and Pet-

rarch did not pass into his poetry. That transmission was reserved for the 16th century. To the end the spirit of Chaucer's poetry is that of the French love-poetry, allegoric and romantic, qualified by his own bent towards a more realistic and humorous handling of conventional themes. This bent achieved its complete emancipation in the Prologue to *The Canterbury Tales*, with its vivid and ironical pictures of all the social types of 14th-century England.

Chaucer's Successors

The best of the tales are in the vein of the Prologue, fabliaux, satiric tales, told with consummate dramatic and poetic art. Only in the fragment of the *Squire's Tale* does the poet reopen the well of pure and enchanting romance. Chaucer gave England a courtly poetry superior in dramatic and poetic interest to the poetry of France. He embellished it with beauties derived from the great Italian poets. He breathed into the whole a spirit entirely English.

Chaucer had no comparable successors for nearly two centuries. John Lydgate and Thomas Oceleve kept faintly burning the tradition of didactic allegory and story, and handed on the lamp to its last representative, Stephen Hawes, author, in Henry VII's reign, of *The Pastime of Pleasure*. In Scotland this courtly poetry enjoyed a brighter S. Martin's summer.

The popular literature of the 15th century is of greater interest than the courtly. The religious drama, the mysteries and miracle plays, reached their highest level in the 14th century, and gave place in the 15th to the moralities. To the 15th century probably belong also the oldest of the ballads which, taking the place of the longer lays, preserved the quintessence of the old romances in a way that was to quicken the romantic spirit with surprising and delightful results in later English poetry. Of artistic prose in Middle English, the tentative beginnings may be best studied in Chaucer's translation of Boetius. The 15th century witnessed a fairly steady advance of prose as an artistic medium whose finest result is the *Morte d'Arthur* of Sir Thomas Malory.

The revival of learning in the 15th century made Italy as definitely the centre of influence in literary fashions as France had been in the 12th and 13th centuries. That influence came to England in two successive waves—from Italy direct in the reign of Henry VIII,

from Italy by way of France in the reign of Elizabeth I. Stephen Hawes was still writing dull allegory, and John Skelton was burlesquing the same in individual fashion; Henry VIII and his musicians followed the older tradition of amorous and gay songs and carols after the French manner; Sir Thomas Wyatt and Henry, earl of Surrey, having "tasted the sweet and stately measures and style of Italian poesie," began to cultivate this more dignified and passionate note in sonnets, in irregular imitations of the *canzone* and other Italian forms, and in songs, all published after their death in Tottel's Miscellany, 1557.

French and Italian Influences

The twenty years which followed was a period of arrested development and of experiment, especially in verse translation from Latin, *e.g.* Arthur Golding's Ovid. The one bright ornament is Thomas Sackville's Induction and Legend of the Duke of Buckingham, contributed in 1563 to The Mirror for Magistrates, which, apart from these poems, was but a dull continuation of Lydgate's moralising "tragedies," and sententiously narrated stories of the overthrow of great men through the fickleness of fortune.

Edmund Spenser's Shepheardes Calendar, 1579, showed the artistic influence of Italy and France reacted upon by the temperament of a people whose national self-consciousness had grown eager and intense, and whose spiritual life was being profoundly modified by that religious Reformation which tended to separate them from their Latin tutors.

Spenser's pastoral, The Shepheardes Calendar, his allegorical romance, The Faerie Queen, 1590-96, and all his shorter poems, satirical, elegiac, and lyrical, reveal as well as the influence of French and Italian poetry, that also of Italian Platonism, of Chaucer, and of Sir Thomas Malory; but the spirit which strives to harmonise the whole is that of an Elizabethan Englishman passionately patriotic and Protestant. And if much remains unharmonised, the discords are held in solution by a style diffuse in picture and melody, a verse in which the grave iambic movement of Sackville's Induction is heightened by every resource of varied cadence which English metre permits, and adorned with all the alliteration and vowel-music which English verse welcomes.

Of all the exotic forms naturalised by Wyatt and Surrey, the sonnet enjoyed the greatest popularity in the closing decades of the 16th century. One sequence of love sonnets, after the fashion of Petrarch's Laura, followed on another in rapid succession, including Sir Philip Sidney's Astrophel and Stella, Samuel Daniel's Delia, Michael Drayton's Idea, Spenser's Amoretti, and the later published Sonnets of Shakespeare. Many of the Elizabethan sonnets are translations and imitations, and abound in the conventional and extravagant conceits which are common to the kind, while few or none have the exquisite perfection of form which makes Petrarch a classic. But on the best of the English sonnets is set the impression of personality—the insolent gallantry and passion of Sidney, the deep thought and exquisite language of Shakespeare.

Elizabethan Poetry

The same poets experimented in many kinds, *e.g.* in the decorative Ovidian idyll (Marlowe's Hero and Leander, Shakespeare's Venus and Adonis and Rape of Lucrece); and the same overwrought rhetoric characterises Daniel's Rosamund, a continuation of the Mirror for Magistrates type of story, and Drayton's antithetic imitations of Ovid's Heroides, imaginary love-letters in verse, England's Heroical Epistles. But Daniel and Drayton cultivated a severer style in their historical poems, suggested by Lucan's Pharsalia, Daniel's Civil Wars between York and Lancaster, and Drayton's Barons' Wars.

Daniel, George Chapman, Drayton, Sir John Davies (author of Orchestra and Nosce Teipsum), John Donne, Sir Henry Wotton, and others cultivated a grave philosophical poetry, frequently epistolary in form, in which Stoicism and Christianity are blended. Distinctively religious poetry, whether Roman Catholic, like Robert Southwell's St. Peter's Complaint and Henry Constable's Spiritual Sonnets, or Protestant, like Joshua Sylvester's translation of Du Bartas's Divine Weeks and Works, shows the same elaboration of style and sentiment. The crown of Elizabethan verse translation is George Chapman's of the Iliad and the Odyssey.

In the closing decades of the century a new impetus was given to song writing by the study of lute music and the coloured, cadenced lyric of the French Renaissance poets, Ronsard and his fellows,

with the result that a lyric of many moods, and a new wealth of imagery and harmony, adorned romance and drama, or was garnered in song-books and anthologies such as England's Helicon and Davison's Poetical Rhapsody. Songs were composed by all the poets of the day, and many of the most charming are anonymous.

Growth of the Drama

The history of the drama in the 16th century is one of shifting and confusing development, of overlapping kinds, of natural evolution crossed and disturbed and directed by extraneous influence. The morality which had produced in the later 15th century such a fine flower of serious drama as Everyman, was responsible in the 16th for the impressive Cradle of Security. Farce of a realistic kind—thumb-nail sketches of low life in London—mingles with the serious element, especially in moralities dealing with the follies of youth.

The general tendency of the morality is to be dull, and this was intensified by the Renaissance schoolmaster's love for the didactic, as in John Rastell's Interlude of the Four Elements; by such political allegory as Lord Governance; and by the Reformation passion for polemic, as in John Bale's The Three Laws, etc., and Lusty Juventus Respublica. Elizabeth I checked this intrusion into controversy. The same Bale's Kyng Johan and a play like Thomas Preston's King Cambyses, or the weird version of Aeschylus's great story, Horestes, show how morality blended with story and developed into the characteristically Elizabethan story play, serious or farcical, or a blend of the two.

Classical influence made itself felt, in England as in other countries, in attempts to reproduce the exact form and features of Seneca's Latin tragedies, *e.g.* in Sackville's Gorboduc, and of Latin comedy, *e.g.* in Nicholas Udall's Ralph Roister Doister. The attempt miscarried, and the dominant type of play of the 1560s and 1570s was the story-play crowded with incident, with little interest of character and no beauty of style.

John Lyly led the way in the reform of the drama as literature with his light and graceful, if flimsy, mythological and courtly comedies. George Peele sweetened the versification and brightened the fancy of comedy and romance; and Robert Greene anticipated the woodland settings and the fair maidens of Shakespeare's As You

Like It. Thomas Kyd achieved a success by his Spanish Tragedy, which popularised the melodramatic revenge-motive and the stilted rhetoric of Seneca, while eliminating the choruses and loosening the structure. But the great forerunner of Shakespeare was Christopher Marlowe (Tamburlaine, Dr. Faustus, Edward II) who gave to serious English drama stateliness and splendour of form while quickening within it the soul of dramatic interest.

Shakespeare's Genius

In William Shakespeare a great tradition found its fullest expression. It was no restraint to him, it seems rather to have been a help, to revise older work, to collaborate with lesser men. But the miracle of genius remains. The tradition broke into a new life in his hands. The old play, the lesser dramatist, found through him their fulfilment. He neither led nor followed, he moved instinctively with the changing currents of taste. His early tragic histories, Henry VI and Richard III, are Marlowesque in spirit and style; his early comedies and romances, *Love's Labour's Lost*, and *A Midsummer Night's Dream*, absorbed and enriched all the currents that flowed more faintly in Lyly and Peele and Greene. As the century draws to an end he satirises the bombast of Marlowe and Kyd through *Ancient Pistol*, and Lyly's Euphues in the wit of Falstaff, and blends heroic history, full of the same spirit as Daniel's and Drayton's Chronicle poems, with genial and boisterous comedy.

And when Jonson turned drama from romance to realism, Shakespeare passed to tragedy—tragedies of character and adverse stars in *Hamlet* and *Julius Caesar*, tragedies of great souls driven from their orbit by passion to clash and destroy and perish in *Othello* and *Lear*—and the style and imagery and verse change with the change of theme. Beaumont and Fletcher revive the flutings and falsetto of romance; Shakespeare, too, turns back to the charm of romantic setting and pathetic lovers and children and flowers and poetry and reconciliation. He works with all his fellows, but gives to each kind of play an infinitely richer dramatic and poetic worth.

English prose in the 16th century felt the influence of Latin in vocabulary and structure. The prose of John Fisher, Thomas Elyot, Roger Ascham, Thomas North, and others is a happy blend

of simple, direct, colloquial English with a free importation of Latin words and a sentence shaping towards the Latin period. The finest product of this are the translations of the Bible, from Tyndale to the Authorised Version, a book which has helped to shape and colour the diction and rhythm of much of the best English prose and verse.

For the last two decades of the century prose, like verse, came under the influence of the taste for elaborate rhetoric. Lyly's Euphues set the fashion of antithesis, alliteration, and artificial simile for a succession of imitators in novels and pamphlets, Robert Greene, Thomas Lodge, Thomas Nash, and Thomas Dekker; though in Nash and Dekker a racy colloquialism blended with, and superseded, the tricks of euphuism. Sidney cultivated a more poetical rhetoric in his *Arcadia*, and, with much less of artifice, in the *Defence of Poesie*. Richard Hooker, in the *Ecclesiastical Polity*, raised the Latinised, periodic prose to a higher level of rhythm and dignified eloquence, and made English a fitting medium for philosophical disquisition.

The literature of the earlier 17th century is as varied in character as that of the 16th. The first fifteen years witnessed the culminating achievement of the drama in Shakespeare's great tragedies and the sombre, extravagant, but impressive work of Marston, Chapman, Middleton, and Webster, and in the sardonic unromantic "humours" comedy of Ben Jonson and his classical tragedies. The work of Beaumont and Fletcher, Massinger and Ford and Shirley marks the setting of the sun of a brilliant day.

John Donne and Ben Jonson

In poetry Spenser found no follower in the endeavour to revive, and give a new significance to, the chivalry of medieval romance. But his pastoralism was variously tuned by many poets, e.g. William Browne, in *Britannia's Pastorals*; Drayton in *The Muses Elizium*; and the Scottish Drummond of Hawthornden, a late Elizabethan, with his Italianism and his love for sonnets and pastorals. The didactic, allegorical, religious aspect of Spenser's work appealed more strongly than the romantic and chivalrous to ardent Protestants like the poet brothers Giles Fletcher (*Christ's Victory and Triumph*) and Phineas Fletcher (*The Purple Island*).

During the 17th century literature moved, on the one hand,

towards an increasing weight and fullness of thought and conceit, to which is sacrificed grace and beauty of form and verse; on the other towards more definiteness, uniformity, and correctness of style and verse. The dominant influences in this twofold movement are the late Elizabethan poets, John Donne and Ben Jonson. The poems, erotic, satirical, complimentary, and religious, of Donne fascinated all the younger, bolder spirits by their intellectual subtleties and passionate perversities of feeling, their rugged strength and felicities of phrase, their violations of smoothness and sweetness in versification with the deep and plangent harmonies they achieve.

Ben Jonson, in his songs and epigrams and odes and verses, complimentary and satirical, combines the same compacted pregnancy of thought with a constant, though not always successful, striving after classical definiteness of form, classical finish, and felicity of phrasing. The influence of both is obvious in English poetry to the time of Cowley and Dryden.

The best disciples of Jonson and Donne are the courtly lyrists, Thomas Carew, Richard Lovelace, John Suckling, Thomas Stanley, the earl of Dorset, the earl of Rochester, Charles Sedley, Aphra Behn, and John Dryden himself in the years after the Restoration. The greatest of them, as artist and poet, is Robert Herrick. The influence of Donne, his metaphysical wit and his passionate egotism, is most directly traceable in the religious poets, Anglican and Roman Catholic—George Herbert, *The Temple*; Henry Vaughan, *Silex Scintillans*; Richard Crashaw, *Steps to the Temple*, and *Carmen Deo Nostro*; in Thomas Traherne, and others. But, together with Donne's influence, that of Italian religious poetry, with its sugared conceits, and the mysticism of Spanish writers, e.g. Theresa of Avila and John of the Cross, can be recognized.

The Poetry of Milton

The greatest of 17th-century poets, John Milton, shares the taste of his age for compacted thought and multifarious learning while despising its fantastic and metaphysical conceits. In Milton's poetry, Ben Jonson's ideal of classical form and finish is ministered to by a finer ear and by a poetic temperament and imagination as spontaneously creative as those of the greatest Elizabethans. The early Cambridge and Horton poems, the

Nativity Ode, At a Solemn Music, On Time, L'Allegro and Il Penseroso, Arcades, On the Marchioness of Winchester, Comus, Lycidas, combine the spontaneity, fancy, and ravishing music of Spenser and Shakespeare with a consciously elaborated art, architectonic, stylistic, and metrical, which, on this scale, was a new thing, and has never been surpassed in English.

Paradise Lost is built from the stern experiences and the rigid political theology of the years of rebellion and pamphleteering. The freshness and charm of the earlier poems are gone, but their loss is compensated for by grandeur of epic creation in incident, character, and setting, and by the most majestic and harmoniously modulated blank verse which English ears have ever heard. Paradise Regained is a paler reflex of these qualities; but into Samson Agonistes, Milton's experiment in classical tragedy, he poured the passion of his own sufferings, the pride of his defiant will, clothing them in words as sublime as they are severe.

But the movement towards classification, definiteness, and perfection which fulfilled itself so strikingly in Milton followed a line of less resistance in the work of Edmund Waller, John Beaumont, John Denham, William Davenant, and Abraham Cowley. In Cowley's Mistress and Pindarique Odes and Davideis the extravagances of the earlier period are made the more obvious by the subsidence of the imaginative passion which in Donne inspired, and condoned, these; but the common aim of the others, conscious or unconscious, was the rejection of this extravagance, the limitation of the pattern which verse might follow, and the exaction of a higher degree of correctness within that pattern.

Dryden and Pope

John Dryden, a poet far inferior to Milton, but the first and among the most accomplished of English men of letters, was dramatist; poet, eulogistic, lyrical, satiric, and didactic; translator; literary critic; and essayist. Dryden in his verse and prose uses the English language as it continues to be used. His satires (*e.g.* Absalom and Achitophel) and didactics (*e.g.* Religio Laici, The Hind and the Panther) are an idealised reflection in verse of easy, masculine conversation or eloquence. His odes are supreme examples of lyrics in which there is not a note of song but all is artfully managed noise and declamation.

Working within a still more limited pattern, Alexander Pope achieved, in the next generation, a yet higher degree of pointed and polished perfection. Nothing can surpass in its own way the eloquence of Eloisa to Abelard, the satirical miniature-painting of The Rape of the Lock, the aphorisms and declamations of the Essay on Criticism and the Essay on Man, the condensed, polished, poisonous satire of the Dunciad, Moral Essays, and Imitations of Horace. Dryden and Pope are the high priests of a school of poets including Prior and Gay among their contemporaries; and a succession of elegant, conventional poets which continued to the end of the 17th century and beyond.

The Restoration drama of England is represented by the high-flown and absurd, but eloquent, heroic plays of Dryden, the pathetic, rhetorical tragedies of Nathaniel Lee and Thomas Otway, the brilliant, polite, licentious comedy of George Etherege, George Farquhar, William Wycherley, John Vanbrugh, and especially William Congreve. Thereafter, with a few exceptions (*e.g.* the plays of Goldsmith and Sheridan and some 20th-century plays), actable drama has not formed an important section of English literature, although many poets—Addison, Thomson, Gray, Wordsworth, Coleridge, Byron, Shelley, Tennyson—have tried their hand at poetic drama.

Development of English Prose

The same idea of uniformity, of a definite but not too rigid pattern, "correctness," shaped the prose of Dryden, Temple, and their followers. The earlier prose of the 17th century shared in the irregular greatness of the poetry. The prose of Francis Bacon's Essays, and History of Henry VII; of the great Anglican preachers, Lancelot Andrewes, John Donne, poet in prose as well as verse, Jeremy Taylor; of philosophical humorists, like Robert Burton (The Anatomy of Melancholy), Thomas Browne (Religio Medici, Urn Burial); the controversial pamphlets of Milton, *e.g.* Areopagitica; the historical memoir-writing of Clarendon (History of the Rebellion)—all illustrate the erudite, imaginative phraseology, the splendid but not perfectly controlled harmony, the too long and complex sentence-structure of a prose which enriched the English language, but was not a fully controlled medium.

A simpler style is traceable in the antithetic sentences of

the character-writers, as in Earle's Microcosmographie; the prose of moderate divines like Chillingworth (The Religion of Protestants) and Hales (Golden Remains); and the virile, well-girt style of the philosopher Hobbes (Leviathan). The strain of racy colloquialism in 17th-century prose, coloured by a sensitive and imaginative temperament, and enriched by the sublimer phraseology of the English Bible, gives individuality to the Grace Abounding to the Chief of Sinners, and Pilgrim's Progress of John Bunyan. A gentler temper sweetens the talkative prose of Izaak Walton's Compleat Angler, and Lives, and the multifarious, witty writings of Thomas Fuller. The new prose, colloquial but urbane and weighty, begins in the sermons of Tillotson and South, the essays of Sir William Temple, and, above all, in the prefaces and essays of John Dryden, whose critical prefaces manifest, for the first time, the qualities of urbanity, ease, and elegance combined with force.

The pamphlets and occasional pieces of Jonathan Swift, from The Tale of a Tub to the Travels by Lemuel Gulliver, made him a power in English political life, and revealed the greatest mastery of irony in the English and perhaps any other tongue. Richard Steele and Joseph Addison, pamphleteers on the other side from Swift, showed in The Tatler and The Spectator how the same style, used with less masculine vigour than in Dryden's, and less incisive virulence than in Swift's, prose, but with a delightful blend of irony and "sweet reasonableness," might be made to inculcate good sense and purer manners in a society which still felt the evil effects of Puritan and Restoration excesses. The Tatler and The Spectator had many successors down to the end of the 17th century, including The Guardian and Johnson's Rambler and Idler.

Birth and Development of the Novel

The most interesting precursors of the English novel were such varied products as the picturesque and sentimental extravagances of Aphra Behn's Oroonoko and The Forced Marriage; Bunyan's realistic allegories; Daniel Defoe's stories, which are almost the complete thing, *e.g.* Robinson Crusoe, Moll Flanders; and the fantastic realism of Jonathan Swift's Gulliver's Travels. But a potent shaping influence was that of the press, which, beginning in the reign of James I, had developed in the

News Books, Mercuries, etc., of the Civil Wars, the last phase of which was the Newsletters of Henry Muddiman and the fuller journalistic work of John Dunton and Daniel Defoe.

The man in whose work these various elements—realistic narrative, the minute portrayal of contemporary life and manners, the didactic interest in conduct—crystallised, finding their centre in the sympathetic analysis of a human soul passing through a moral crisis, was Samuel Richardson, whose *Pamela*, *Clarissa*, and *Sir Charles Grandison* created a type of prose work which has been more assiduously cultivated in France than in England. A different kind of plot, full of adventures at inns, bringing together all sorts and conditions of men, a more masculine philosophy of life and conduct, was used by Henry Fielding, dramatist, essayist, and novelist; his *Joseph Andrews*, *Jonathan Wild*, *Tom Jones*, and *Amelia* are the most vivid pictures extant of English life in the 18th century.

Smollett and Goldsmith

Fielding was followed by an ill-conditioned Scot of genius, Tobias Smollett, a sardonic and angry recorder of sordid and violent life, the creator of some immortal types in *Roderick Random*, *Peregrine Pickle*, and *Humphrey Clinker*. Laurence Sterne's self-conscious sentiment and whimsical humour, which owed much to Rabelais, Montaigne, Cervantes, Burton, and Swift, found expression in *The Life and Opinions of Tristram Shandy, Gent.*, and *The Sentimental Journey*—tales which, following no plan, vindicated the right of the novel to take what form it please, so it mirror the idiosyncrasies of character and feeling. Among the followers of these great recorders of manners is Frances Burney, with *Evelina*, *Cecilia*, and *Camilla*; while Johnson's *Rasselas* is but an expanded epilogue of the type of Addison's *Vision of Mirza*. Goldsmith's *The Vicar of Wakefield*, with its fanciful, humorous, pathetic picture of life seen through the idealising atmosphere of reminiscence, had an influence on Goethe and Continental writers hardly inferior to that of Richardson. In Horace Walpole's *Castle of Otranto* the first wave of the Gothic revival reached the novel.

The novel was only one channel of prose literature in the century. If the didactic spirit invaded and chilled poetry, the regard for form, for correctness, elegance, and dig-

nity of composition gave artistic interest to work of kinds which a later age has too scrupulously divorced from literature. John Locke (*Essay Concerning Human Understanding*) was a diffuse and cumbersome writer; but there are few finer practitioners in prose than George Berkeley (*Three Dialogues, Alciphron*) and David Hume (*Essays*). Johnson, poet, lexicographer, essayist, and critic, sacrificed lightness of style for force and dignity, not untouched with pomposity, qualities not more evident in his own work than in the record of his conversation preserved in James Boswell's *immortal Life*.

Edward Gibbon made the same dignified prose the purple vestment of his not more learned than splendidly ordered *Decline and Fall of the Roman Empire*. Edmund Burke, the most diffuse and gorgeous of English orators, combined with eloquence a unique intellectual and imaginative insight into politics, the mainspring of man's social nature.

A didactic purpose, a regard for "correctness" within a narrow but widening pattern of diction and verse, are the accepted principles of English poetry to the time of Blake and Wordsworth, and even later. The beginnings of a change showed themselves first rather in an enlarged choice of subjects—Nature, the Middle Ages, Liberty, and the Natural (as opposed to Civilized) Man—than in any radical difference in spirit and style.

Augustan Conventions

James Thomson's blank-verse *Seasons*; John Dyer's octosyllabic *Grongar Hill*; Thomas Gray's pensive *Ode on a Distant Prospect of Eton College*, or *Elegy in a Country Churchyard*; and the equally pensive, less finished and sustained, but more spontaneous and sensitive odes of William Collins; the minor poetry of the Wartons, Thomas and Joseph, and of Mark Akenside; the poems, more Pope-like in form, of Dr. Johnson (*e.g.* *The Vanity of Human Wishes*); Oliver Goldsmith's *The Deserted Village*; and George Crabbe's *The Village*, all in different ways show change, but are still Augustan in their conventional "poetic diction," their studied "correctness" in spirit and form; and so, despite their romantic themes, are Gray's more ambitious odes, *The Progress of Poesy* and *The Bard*.

But a new spirit was to find its proper style, to substitute for a poetic heightening of eloquence a

style whose ideal is the free and natural outpouring of the heart. The frost is loosening in the poetic prose of Macpherson's *Ossian*, and Chatterton's *Rowley Poems*, in Goldsmith, and in Cowper's *The Task*. It is broken up in the *Songs of Innocence* and *Songs of Experience* of William Blake, mystical poet and painter, and in the *Lyrical Ballads* of Wordsworth and Coleridge which, appearing in 1798, were a gage deliberately thrown down to the prevailing classicism.

The long poetical career of William Wordsworth was run in the fervour of imaginative and mystical insight into the life of nature to which he had attained through the meditative country life of his youth and the spiritual agitations of the French Revolution. *The Prelude*, *The Excursion*, *The Recluse*, fragments of a never-completed autobiography and spiritual creed in blank verse; lyrical and narrative poems inspired by nature, childhood, the peasant, the affections, patriotic sonnets, have one common theme, and are composed in a style of which Wordsworth was disposed to make something of a religion—"the real language of man" often falling into bathos, but at its best unique in passionate, imaginative simplicity.

Coleridge's best poetry shows the influence of Wordsworth in thought and feeling and style, but what is most individual in *The Ancient Mariner*, *Christabel*, *Kubla Khan*, is rather the magic reawakened sense of beauty and mystery expressed in phrase and in subtle verbal music and cadence.

Poetry of Scott and Byron

The spirit and art of Wordsworth's and Coleridge's poetry were too new and elusive for immediate appreciation. Public taste had to be stimulated by the more crudely romantic poetry of Walter Scott, Byron, and Thomas Moore. Scott's stirring but somewhat rococo lays are of less pure poetic worth than the delightful snatches of song in which he revived the impersonal, chivalrous note of medieval lyric. The fiery, brilliant, crude improvisations of Byron in lyric and lay, and the blend of description and rhapsody in *Childe Harold* are the unreflective, potent expression of the spirit of pure revolt in romanticism, but Byron's best work was satire in conversational style and *ottava rima*, like *Beppo*, and *Don Juan*. Scott and Byron enjoyed a European reputation. They are the most human and worldly of the

poets of the period; there is more passionate flesh and blood in Byron's technically inferior work than in the work of any poet using the English language save Shakespeare and Burns.

The "desire of the moth for the star" is the burden of the lyrical dramas (*Prometheus Unbound* and *Hellas*), rhapsodies (*Alastor*), elegiac poems (*Adonais*), and songs in winged and ethereal rhythms of Percy Bysshe Shelley. Beauty, the beauties of nature, of Spenser's poems, of medieval chivalry, of Greek mythology and art, of Miltonic cadences and Shakespearean phrases, are the theme and inspiration of the *Endymion* and later poems and odes of John Keats. The curiously carved *Gebir*, *Hellenics* and *Lyrics* of Walter Savage Landor are inspired by a like sense of the statuesque beauties of Greek poems.

The Revolutionary Novels

The last great novelist in the 18th-century school of manners and character was Jane Austen, whose *Northanger Abbey* was an early skit on the new romantic novel. Her exquisite pictures of genteel English life in the country and at Bath include *Pride and Prejudice*, *Emma*, and *Persuasion*. But the novel, too, came under the influence of the taste for romantic scenery, a medieval atmosphere, the marvellous and mysterious, dreams of the perfectibility of human nature and political regeneration. The result is seen in revolutionary novels like William Godwin's *Caleb Williams*; didactic stories like Thomas Day's *Sandford and Merton* and Miss Edgeworth's tales; Mrs. Radcliffe's tales of the "explained supernatural," *The Mysteries of Udolpho*; crude historical fiction like Clare Reeve's *The Old English Baron*, Jane Porter's *The Scottish Chiefs*.

In the *Waverley Novels*, from *Waverley* to *Count Robert of Paris*, Walter Scott combined and harmonised the interest in character and manners of the great 18th-century novelists, the romantic passion for other times and other manners and for a picturesque setting in scenery rich in historical associations, and that respect and affection for the peasantry which had grown steadily throughout the 18th century from Thomson and Gray to Rousseau and Burns and Wordsworth.

The influence of the romantic movement on prose work other than the novel can be studied in the picturesque, archaically coloured,

prose essays and critical studies of Charles Lamb (*Essays of Elia*, *Specimens from the Dramatic Poets*); in the vivid, passionate, impressionistic essays and criticism of William Hazlitt (*Lectures on the English Poets*, *Lectures on the English Comic Writers*); in the cadenced prose, musical and fanciful, of Thomas De Quincey (*The Confessions of an Opium Eater*); and in the pleasant chat about letters and art and scenery of Leigh Hunt (*The Examiner*, etc.). William Cobbett's racy, idiomatic prose in *Rural Rides* continues the tradition of South and Swift.

The poetry of the reign of Queen Victoria is a continuation and elaboration of the romantic revival. The chief themes are the same—nature, the romantic past, medieval and classical, the problems of life and death. There is less of the suggestion of a prophetic burden (that is taken over by prose writers like Carlyle and Ruskin) than in Wordsworth and Shelley, more of consciously artistic handling, of antiquarian accuracy of reproduction, of analysis and inquiry, of dramatic interest which, except in Scott, had been somewhat overshadowed by the large topics—nature and liberty and romance. The purification of style, the rejection of a stereotyped convention in poetic diction, had led to an enrichment of phraseology, a more imaginative style that owes much to older poets, and in the elaboration of which Keats is a principal agent.

Tennyson and Browning

The most representative poet is Alfred Tennyson, whose careful experiments in the artistic expression of moods culminated in the two volumes of 1842, lyrics and idylls of nature and English rural life, of character (*Simon Stylites*, and *Ulysses*), of medieval and classical legend, and of the problems of sin and death and immortality (*The Vision of Sin*). In the years which followed, the style thus studied and mastered became the medium of longer, more ambitious, not always entirely successful poems: *The Princess*, *In Memoriam*, *Idylls of the King*—jewelled settings of tales from Malory and the *Mabinogion*, touched with the feeling of his own day. Tennyson's later poems reflect with great but unequal power his passionate patriotism and the trouble of soul with which he contemplated the spirit of his age.

A wider dramatic range, a more curiously analytical mind, a more

colloquial style, and a less melodious but more varied verse distinguish the not essentially different dramatic monologues and lyrics of Robert Browning. He followed long and somewhat chaotic and obscure poems, of which the happiest is *Paracelsus*, by experiments in drama intended to be acted (as some were); and then Browning found himself in a series of shorter dramatic lyrics and monologues, beginning with *Pippa Passes* and closing with *Dramatis Personae*. The longest of his dramatic, analytical studies of the human soul, *The Ring and the Book*, was followed by many similar studies, subtly intellectual but more fitfully inspired.

As a revival of the life and art and spirit of past times the movement which began in the 18th century culminated in the exotic cultured poetry of the middle of the 19th century. But this poetry also reflects that change of spiritual temper which troubled Tennyson and Browning—on the one hand the revival, actual or artistic, of medieval Catholicism, on the other the Lucretian philosophy of life which was the outcome of scientific developments.

Learning and Lyrical Inspiration

In this philosophy, in the poetry of Greece, in Goethe and Wordsworth, Matthew Arnold found the inspiration of poems, lyrical, narrative, and in Greek dramatic form, with a piercing elegiac note of their own. Medieval art, early Italian poetry, Keats and Browning were the influences which shaped and coloured the ballads, monologues, sonnets, and lyrics, sensuous, mystical, and elaborate, of Dante Gabriel Rossetti. Early French poetry, Froissart and Chaucer, Rossetti and Browning, the architecture and decorative arts of the 12th and 13th centuries, the passionate, stoical heroism of Icelandic myth and saga, a socialism which is in part an artist's hatred of machinery and commerce, are the blended strains in the lyrical and narrative poetry and prose of William Morris, reteller of stories after the manner of Chaucer, but without his humour.

A deeper sympathetic comprehension of the spirit, but even more of the form, the metrical complexities and beauties, of Greek poetry, superior to that of Gray, perhaps even of Milton (for Milton was limited by the scholarship, more Latin than Greek, of his day); an equally intimate knowledge and understanding of French

poetry from Villon to Victor Hugo; a love amounting to idolatry for Shakespeare and the Elizabethan dramatists—are the sources of the poetry, decorative and intoxicatingly harmonious, of Algernon Charles Swinburne. Never have learning and lyrical inspiration been more strangely blended; never has poetry so spontaneously lyrical been so purely literary in its sources and motives.

To the same school belongs the intimate, ascetic, religious poetry of Christina Rossetti; and one of the most remarkable products of the tendency to find inspiration in the past and adapt old forms to current feeling was Edward Fitzgerald's *Rubaiyat of Omar Khayyam*. Lesser works worthy of note include Keble's *The Christian Year*; the *Lays of Lord Macaulay*; the *Festus of Bailey*; the poetry of Taylor, Alexander Smith, Sidney Dobell, and Arthur O'Shaughnessy; the lighter verse of William Edmonstoune Aytoun, C. S. Calverley, and Lewis Carroll.

Among the many prose writers other than novelists of the early and middle 19th century, historians like George Grote (*History of Greece*); Lord Macaulay (*Essays, History of England*); James Anthony Froude (*History of England*); philosophers like John Stuart Mill, (*Logic, On Liberty, Utilitarianism*); and Herbert Spencer (*Principles of Psychology, First Principles*); theologians and religious writers like John Henry Newman (*Apologia pro Vita Sua, Grammar of Assent*); critics of literature and art like Matthew Arnold (*Essays on Criticism*); and Walter Pater (*Studies in the History of the Renaissance, Marius the Epicurean, Appreciations*), two stand out.

Carlyle: Tormented Prophet

The first is Thomas Carlyle, the tormented, passionate, eloquent prophet of duty and work, whose *Sartor Resartus* is at once a spiritual autobiography and a philosophy, following Swift and Burke, of the clothes, political and religious, in which the human spirit is ever concealing its "shivering nakedness," only to find them grow old and drop away, if they are not burnt up in Reformations and Revolutions, and to begin again to weave them on time's tireless loom.

In *The French Revolution* Carlyle portrayed, with an amazing vividness of dramatic and cinematographic presentation, an era of dissolution and rebirth, the flaming apparition of modern democracy

In *Heroes and Hero-worship*, *Cromwell's Letters and Speeches*, and *History of Frederick II*, he dilated upon and dramatically reconstructed some of those great spirits who, penetrating to the reality which underlies the illusions of life, are the best exemplars of his creed of hero-worship. The reference to current events which runs through all his work found clearest expression in *Chartism, Past and Present*, and *Latter-Day Pamphlets*.

The other Victorian prophet is John Ruskin, the musically eloquent expounder of art, painting, and architecture in relation to the moral nature of man and the ordering of society. Ruskin's *Modern Painters*, *Seven Lamps of Architecture*, *Stones of Venice*, *Unto this Last*, *Sesame and Lilies*, *Fors Clavigera*, *Praeterita* are among the principal works which brought art close to literature.

A less prophetic but equally prejudiced and individual writer of the period was George Borrow, the first interpreter of the Gypsy character, and a writer of natural, racy prose in, *e.g.*, *Lavengro*, and *The Romany Rye*.

Dickens and Thackeray

The Victorian novel continued, with certain definite limitations imposed upon it by the moral taste of the time, the serious and humorous portrayal and the active criticism of contemporary life and manners, with occasional digressions into the historical, developed in the 18th century. Charles Dickens, humorist, sentimentalist, pictorial describer, and dramatic, not to say melodramatic, narrator, social critic and reformer, began with *The Pickwick Papers* a series of novels and tales that enthralled the readers of the world. The greatest are probably *Pickwick*, *Martin Chuzzlewit*, *David Copperfield*, *Great Expectations*, and *Our Mutual Friend*. *Barnaby Rudge* and *A Tale of Two Cities* are historical novels, the second coloured by the reading of Carlyle's *French Revolution*. Dickens's favourite subject was the character and manners of the lower middle class.

But the most penetrating critic of the devastating snobbishness of English upper class society, never worse than at this time, when wealthy merchants were pressing for aristocratic recognition, was William Makepeace Thackeray, the most unerring portrayer since Fielding of human nature as it is, the novelist who has no heroes. *Vanity Fair*, *Pendennis*, and *The*

Newcomes are, with his shorter sketches, the greatest of his novels of contemporary life. In *Henry Esmond*, and in a lesser degree in its sequel *The Virginians*, the same delicacy of satirical and sympathetic portraiture is given an historical setting of wonderful comprehensiveness and atmosphere.

The early sketches of provincial life by George Eliot (Mary Anne Evans), *Scenes from Clerical Life*, and her novels *Adam Bede*, *The Mill on the Floss*, *Silas Marner*, *Felix Holt*, have a freshness and power that somewhat failed her in her later more learned and philosophical works, *e.g.* *Romola*, though *Middlemarch* is often ranked among the richest of English novels.

Propaganda Through the Novel

The tendency to make of the novel a political, social, or ethical and religious pamphlet is dominant in the brilliant political novels of Benjamin Disraeli (*Coningsby*, *Sybil*, *Tancred*, *Lothair*, and *Endymion*); in the ardent and vivid pictures of contemporary and past problems and agitations of Charles Kingsley (*Alton Locke*, *Hypatia*, *Westward Ho!*, *Hereward the Wake*); and in the stories of Mrs. Gaskell. The Brontë sisters, Charlotte (in *Jane Eyre*, *Villette*) and Emily (in *Wuthering Heights*), poured into the same form the lyrical record of their own lives and passionate thoughts. Anthony Trollope, with his delightful sketches of clerical society in the *Barchester* series; Charles Reade, ardent social reformer (*It Is Never Too Late to Mend*, *The Cloister and the Hearth*); and Lord Lytton, experimenter in all kinds of novels (*The Caxtons*, *My Novel*, *The Last Days of Pompeii*, *A Strange Story*) are typical Victorian novelists.

H. J. C. Grierson

Literature seldom falls into well-defined compartments, identifiable by date, subject, or style. Even the superficially "tidy" 18th century is diversified by such things as the poetry of Blake, Macpherson's *Ossian*, and Beckford's *Vathek*, lying outside its main scheme. So there can be no facile classification of literary trends after 1870 in view of the kaleidoscopic shiftings which the period displays. Thus while the aestheticism, the frequent decadence of the 1890s are indubitable, that fertile decade also included much vigorous and virile work by men already well established earlier, and saw the beginnings of authors of intellectual

eminence like H. G. Wells and Bernard Shaw who were later to become major prophets.

The Education Act of 1870 gave a powerful if gradual stimulus to the production of a literate public. The educational work of the mechanics' institutes, the foundation of new universities and colleges, the growth of the public library system, and sundry publishing firms, by producing excellent cheap series, were among the chief agencies fostering an avid demand for books. The demand was met with a plethoric production

19th-Century Novels

The novel remained the most popular form of literary expression until, roughly, the early 1950s. Two of the earlier men of the period, despite dissimilarities, have so much in common in their intellectual climate that they may be considered together. These are George Meredith (1828-1909) and Henry James (1843-1916). Meredith came of a tailoring and inn-keeping family, but his interests were aristocratic and his novels dealt chiefly with complex emotional reactions in high society. His books lack warmth and humanity, and by many readers are found difficult and obscure (*The Ordeal of Richard Feverel*, 1859; *The Egoist*, 1879). Meredith also wrote much poetry of delicate and refined sensibility.

James, an American, was domiciled so long in England and was so impregnated with Western European culture that his work belongs to English literature. His novels, like Meredith's, are caviare to the general; but he has his devoted addicts among connoisseurs of style. That style bodies forth subtlety of apprehension in a language which assiduously (but often painfully and too obviously) seeks out extreme and exquisite precision of expression (*What Maisie Knew*, 1897; *The Turn of the Screw*, 1898).

Robert Louis Stevenson (1850-94) was in spirit far removed from these two intellectuals, though, like them he was obsessed by the search for style, and, in his own words, "played the sedulous ape" to one master after another. But his vivid charm suffused everything he wrote, and he became one of the great story-tellers of his period. *Treasure Island*, 1883, remains a classic of boys' literature; his Scottish stories (e.g. *Kidnapped*, 1886) show deep knowledge of the national character; and works like *Dr. Jekyll and Mr. Hyde*,

1886, and *Thrawn Janet* (in *New Arabian Nights*, 1882) show a mastery of the eerie and the macabre which was to reappear later in the work of men like Algernon Blackwood and Oliver Onions. Stevenson also wrote delicately wrought poetry and admirable familiar essays.

Outside all cliques and movements, the many-sided talent of Rudyard Kipling (1865-1936) shone brightly for many years. He finds a place here for such novels as *Kim*, 1901, a remarkable coloured tapestry of Indian life, the boy-life books like *Stalky and Co.*, 1899, and others; but he also produced poems, grave and serio-comic, travel books; books about animals, and much else. In the decades after his death it became fashionable to sneer at him for his robust imperialism ("lesser breeds without the law"), but such denigration belongs rather to politics than to literature. His "*Barrack-Room Ballads*," 1892, catch the real idiom of the British private soldier. Likewise the stories in *Soldiers Three*, 1888, play over military life with keen humour and sympathy. Whatever he wrote, he had a vigorous and racy style. Oddly (for so English an author) he had a great vogue in France.

Thomas Hardy

Born a quarter-century earlier but surviving nearly as long was the commanding genius Thomas Hardy (1840-1928) who first won fame with his novels and then built up a new reputation in the art he preferred—poetry. The novels, mainly set in "Wessex" (Dorset and adjacent regions), range in mood from delicious rural comedy to solemn and heart-searing tragedy. The best of them (*The Return of the Native*, 1878; *Tess of the d'Urbervilles*, 1891; *Jude the Obscure*, 1896) are among the majestic things of his time. Hardy's fiction, in the main, concerns itself with the lives and loves of rural people and is in part aimed at demolishing what he called "that pitiable dummy Hodge." The landscape, closely observed, deftly limned, and often linked with its prehistoric past, is well-nigh perfect. The characters, where they belong to the labouring and farming classes, are likewise well-wrought, and are subject to the same aspirations, passions, and frustrations as their fellows in the town. He seems less happy with professional and county types. All, whatever their class or

status, are creatures of their environment, and their lives are moulded by the operations of an ineluctable and nescient fate—for his austere philosophy admits of no benevolent personal deity, but only a "First or Fundamental Energy" that works blindly. His philosophic attitude becomes ever clearer and more overt in definition as his work progresses, and reaches its fullest expression in the great verse-drama, *The Dynasts*, 1903-1908. It colours, too, the lyrical poems, which have an ironical tang and an individual metrical beauty that make many of them memorable.

George Moore—Hudson—Conrad

Much narrower in intellectual range and poorer in human sympathy was George Moore (1852-1933), who, after failing as a painter, bid fair to fail also as an author, because of downright bad writing in his early works. But by sheer persistence and hard labour he shaped his prose as a literary implement which in the end became highly polished. His realistic novel *Esther Waters*, 1894, technically springing from French sources, firmly established his reputation, which was consolidated by such autobiographical writings as *Hail and Farewell*, 1911-14, and two novels on epic themes, *The Brook Kerith*, 1916, and *Héloïse and Abélard*, 1921.

The turning century saw the late success of men like W. H. Hudson and Joseph Conrad whose literary beginnings had met with little public recognition. It also saw the first works of sundry men who were to add lustre to the history of the English novel, namely H. G. Wells, Arnold Bennett, John Galsworthy, Somerset Maugham.

W. H. Hudson (1841-1922) was over 50 when he first attracted attention with *The Naturalist in La Plata*, 1892, though the early work *The Purple Land that England Lost*, 1885, came to be considered one of his best productions. His background of South American life, his deep knowledge of animals and birds, his wonderful feeling for natural beauty, give a fine freshness to his writings, among which probably the most highly esteemed is *Green Mansions*, 1904.

Joseph Conrad (1857-1924), a Polish sea-captain naturalised British in 1886, was a far more significant literary figure, who, indeed, stands right on the top peak among artists in fiction working in the English language. His travels and encounters in and

around the Malayan archipelago gave him a rich and exciting subject-matter; but he was far from being a novelist only of the sea and the jungle. Strange dilemmas of human conscience and involutions of character fascinated him (he must have been the most subjective-minded master-mariner that ever existed); and he wrote of these things in a subtly-contrived prose and often in a strange involved technique of story-telling. Among his chief works are *The Nigger of the Narcissus*, 1897; *Lord Jim*, 1900; *Typhoon* (stories), 1903; and *Chance*, 1913.

Though his apprehension of the world differs profoundly from that of Conrad, as does his crystal-clear economic prose contrast with that of the Polish master, it is convenient here to name William Somerset Maugham (b. 1874). Maugham too has rich memories of travels in the Malayan and Polynesian regions, and, like Conrad, he is a masterly teller of tales. Again like Conrad, he drew much from French literature, and this is well seen in his autobiographical novel, *Of Human Bondage*, 1915. In the early part of the century he occupied himself chiefly with dramatic work, but then came many brilliant novels like *The Moon and Sixpence*, 1919; *The Painted Veil*, 1925; *The Narrow Corner*, 1932; and *The Razor's Edge*, 1944; and some of the best short stories in the English language.

Wells—Galsworthy—Bennett

Three others among the older generation of novelists bid fair to rank as classics of the earlier part of the 20th century—H. G. Wells (1866–1946), John Galsworthy (1867–1933), and Arnold Bennett (1867–1931). Each in his fashion reflected the lives and interests of different sections of the middle classes, ranging from Wells's small tradesmen at the one end to Galsworthy's solid "men of property" at the other.

Wells began with scientific romances like *The Time Machine*, 1895, which foreshadowed much that has come to pass. From his beginnings he had a remarkable faculty for confronting little, ordinary men with cataclysmic events; and the ordinary lives of those same little men, earnest, struggling, lovable, and unfulfilled, are depicted with verve, humour, and understanding in books like *Love and Mr. Lewisham*, 1900; *Kipps*, 1905; and *The History of Mr. Polly*, 1910. Wells saw society

as stupid and disorganized and riddled with superstition, and spent much of his volcanic energy on trying to set it to rights. Socialism was one of his early panaceas (*New Worlds for Old*, 1908); then came a reassessment of the past in *The Outline of History*, 1920. As he grew older his ideas widened out into schemes for world organization; he died disappointed that mankind remained so far from the ideal he envisaged.

While in Wells social criticism is overt, in Galsworthy it is implicit (at least in the novels; the plays are fiercer). He is the chronicler *par excellence* of the prosperous Edwardian business man, showing the insensitive complacency of the type in the face of obvious misery among those less well-endowed. Not that Galsworthy fails to see such virtues as prudence, the love of home, and honest dealing and efficiency in business. He is the master of atmosphere and character, brought out by delicate touching-in of ordinary scenes and episodes; his women have a magic quality of their own; and even the dogs which he loved are essential parts of the stories in which they figure. The whole fabric of the novels is suffused with gentle and civilized humanitarianism. *The Man of Property*, 1906, introduced the Forsyte family, of subsequent fame. They did not reappear until 1918, with the exquisite short story, *Indian Summer of a Forsyte* (in *Five Tales*); but thereafter, at intervals, appeared a whole imposing series which came to be called *The Forsyte Saga*, and ended with *Swan Song*, in 1928.

Arnold Bennett (1867–1931) described (and belonged to) a section of the middle classes far less opulent and securely settled than the Galsworthian group with their investments, servants, and big houses. He arrived from Staffordshire determined to make good, and succeeded in making both a financial success and a *succès d'estime*. The first arose partly from "pot-boilers" like *The Grand Babylon Hotel*, 1902, and partly from the great *Five Towns* books which placed him among the mighty—especially *The Old Wives' Tale*, 1908, and *Clayhanger*, 1911. "His strength," wrote Frank Swinnerton in the *D.N.B.*, "lay in the unique degree of his love for simple people, and in his ability to see interest and beauty in much that to the superficial eye is squalid or tedious."

The literary chronicle of the period moves on, and many richly-endowed writers in varying styles adorn its pages. Sir Hugh Walpole (1884–1941), himself the son of a bishop, portrayed (among much else) the inwardness of clerical intrigue in cathedral towns; Sir Arthur Conan Doyle (1859–1930) revived the medieval past with spirit, and in *Sherlock Holmes* created a whole school of detective fiction; E. M. Forster (b. 1879) and Charles Morgan (b. 1894), both subtle and conscientious artists, had their large following among the *cognoscenti* as writers of delicate percipience in the analysis of human motive; Aldous Huxley (b. 1894) began as a gaily ironical chronicler of the hilarious 1920s and turned later to more philosophical courses; J. B. Priestley (b. 1894), who sprang to fame with his picaresque novel, *The Good Companions*, 1929, proved a many-sided man distinguished also as a critic and playwright.

20th-Century Galaxy

Belloc, Chesterton, Compton Mackenzie, May Sinclair, Phyllis Bentley, Phyllis Bottome, Robert Graves, Richard Aldington, "Richard Llewellyn" (Lloyd), David Garnett, C. S. Forester, H. E. Bates . . . so the list runs on, of men and women of high literary ability each contributing in his or her own way to the long roll-call of English novelists. And certain single works must be picked out for their very special quality. Samuel Butler's autobiographical novel *The Way of All Flesh*, published posthumously in 1903, is a masterly, quiet, scathing indictment of the religious Victorian home; his ironical Utopian *Erewhon*, 1872, had a wide and pervasive influence; Kenneth Grahame's *The Wind in the Willows*, 1908, suffused with a lambent humour, and full of poetic overtones, has its special place; and *South Wind*, 1917, by "Norman Douglas" (George Norman Douglas), is a remarkable *tour de force*, compact of erudition, irony, wit, high spirits, and natural description, told in a vivid, elaborate, gorgeous prose that was entirely personal.

Broadly speaking, most of these authors used the classic structure of the novel (though Aldous Huxley made time-sequence experiments). Even the powerful, challenging D. H. Lawrence (1885–1930) was an innovator not so much in construction as in his deeply-felt and courageous

polemic for greater freedom of the human spirit, centring in sexual fulfilment.

But there were several real experimentalists in form. Virginia Woolf (1882-1941) was one of the most subtle and successful of these, with such books as *Orlando*, 1928, and *To the Lighthouse*, 1927. She made attempts (some of them very successful) in what has been variously called the "stream of consciousness" or "interior monologue" technique, which purported to reproduce the divagations of the human mind in a state of reverie. It was used also by Dorothy M. Richardson (b. 1882) and by that remarkable Irishman, James Joyce (1882-1941), who claimed to have discovered it in a forgotten novel by Édouard Dujardin called *Les Lauriers sont coupés*, 1888. Discussion of Joyce's masterpiece, *Ulysses*, 1922, has covered acres of paper. Above all it is profoundly Irish, not only in thought but in expression, and its brilliance of insight and tremendous humorous force can be truly savoured only by a reader who has lived in Ireland and knows how Irishmen live, reason (or fail to reason), and speak. His word-coinages are for the most part apt and ingenious, though unfortunately in his last work, *Finnegan's Wake*, 1939, they are allowed to run riot into obscurity. Earlier works like *Dubliners*, 1914, and *A Portrait of the Artist as a Young Man*, 1916, have higher qualities.

Renaissance of the Drama

From the time of Sheridan the English drama languished in a swamp of mediocrity for about a century. In the 1880s a revival became evident, especially in the social drama of Henry Arthur Jones (1851-1929) and Arthur W. Pinero (1855-1934), quickly followed by the kingfisher-like apparition of Oscar Wilde (1854-1900). Without being a genius or a deep thinker, Jones was one of the most accomplished theatrical craftsmen of his time, and a master of situation and of natural dialogue (*The Silver King*, in collaboration, 1882; *The Liars*, 1897). Pinero, likewise, was a consummate technician, and in an output of over 50 plays wrote at least one—*The Second Mrs. Tanqueray*, 1893—that made theatrical history.

Far outstripping these dramatists in talent, in wit, and ultimately in world-wide *réclame* was the eccentric, precious, amoral

Oscar Wilde, perhaps the most typical figure in that period of transition and effervescence, "the 1890s"—a period in which Victorian values were in process of liquidation and in which many men of letters were writing not so much out of the plain need for self-expression as by compulsion of aesthetic theories, some of them arising out of the writings of Walter Horatio Pater (1839-94). It was a period in which "Art" began to be spelt with a capital letter, and in which artists (not always to the benefit of their work) began to think of themselves as souls apart, living in an ethereal atmosphere not to be understood or entered by the average man. Wilde's novel, *The Picture of Dorian Gray*, 1891, despite its sensuousness and its undercurrent of diabolism, had a clear and unequivocal moral compulsion. Then came the brilliant, flashing comedies—*Lady Windermere's Fan*, 1893; *A Woman of No Importance*, 1894; and others. Here was sparkling wit and impudent, well-turned paradox (much of it hinging on the inverted proverb) the like of which had hardly been seen before on the English stage.

Realism in the Theatre

There is more than a touch of fantasy in the superbly-turned phrases of Wilde's characters; but soon the tide of realism, bearing the ship of Henrik Ibsen, was to rise full flood. It brought with it as its most important argosy the work of George Bernard Shaw (1856-1950), like Wilde in being an Irishman but in nothing else. Socialist, teetotaler, non-smoker, vegetarian, freethinker, anti-vaccinationist, Shaw had all the outward stigmata of a crank, but was saved by his agile brain and brilliant wit from being either a bore or a mugwump. He belaboured with a will such things as slum landlordism, prostitution, narrow patriotism, medical mumbo-jumbo. He found means of expression in social plays like *Arms and the Man*, 1894; *John Bull's Other Island*, 1904; and *The Doctor's Dilemma*, 1906; in philosophical plays like *Man and Superman*, 1903, and *Back to Methuselah*, 1917-20; and even turned to history, seen in his own unorthodox light, in *Saint Joan*, 1923. By sheer wit, and force of character, and dramatic skill, he carried with him audiences composed for the most part of people holding views inimical to his own

—and this in spite of the enormously long speeches he often put into the mouths of his characters. The lucidly-argued prefaces which were published with the plays are models of prose polemic on a very high level.

Yet a third type of Irishman, full of the fey (and often sinister) poetry of the Celtic spirit, was John M. Synge (1871-1909), who was associated with the Abbey Theatre, Dublin (where several of his plays were hissed or caused rioting because of their unpromising views of some aspects of Irish character). Of the half-dozen or so plays he left, the most distinguished and memorable is *The Playboy of the Western World*, 1907, in which a superb verbal music is produced by using "one or two words only that I have not heard among the country people of Ireland, or spoken in my own nursery before I could read the newspapers."

In despite of two world wars, a long and miserable economic slump, and the competition of the cinema, the theatre in England retained its vitality, and various dramatic genres were well represented by (among others) J. M. Barrie, Lord Dunsany, St. John Ervine, John Galsworthy, W. Somerset Maugham, Stanley Houghton, "James Bridie" (O. H. Mavor), Noël Coward, Terence Rattigan, Séan O'Casey, Rudolf Besier, William Douglas Home, Emlyn Williams, Christopher Fry.

Poets of 1870-1980

Many practitioners of verse contributed worthy material to the treasury of English poetry. Meredith, Hardy, Kipling have considerable status in this world as well as in the domain of prose. Hardy's fame as a novelist has overshadowed his achievement as a poet; but it should not be forgotten that his first lyric is dated 1865, that the last thirty years of his life were devoted entirely to poetry, and that he himself esteemed his verse more highly than his prose.

Minor poets there were in plenty during this period. Perhaps the most distinguished was the sad, other-worldly, drug-sodden figure of Francis Thompson, who, by grace of the Meynell family (who rescued him from the extremes of poverty and degradation), published a few volumes of exquisitely-turned lyrical poetry, mystically religious in feeling. Others at work in the 'nineties who had their gleams of felicity were

John Davidson (1857-1909), Richard Le Gallienne (1866-1947), Lionel Johnson (1867-1902), Ernest Dowson (1867-1900), Wilfrid Scawen Blunt (1840-1922), and Alice Meynell (1847-1922). Sometimes the gleams flamed up into a blaze of near-genius, as in Dowson's "I have loved thee, Cynara." Among the lighter versifiers W. S. Gilbert (1836-1911), collaborator in the famous Gilbert and Sullivan operas, wrote hundreds of skillfully-rhymed and witty lyrics, phrases from which have passed into the language. Austin Dobson (1840-1921) was a finished and stylish practitioner of such charming and difficult French forms as the rondeau, the ballade, and the triolet. In the realm of sheer farce Hilaire Belloc's *Cautionary Tales*, 1907, are delicious.

Significant Figure of Yeats

A far larger figure than any of these was William Butler Yeats (1865-1939), another Irishman, described by Holbrook Jackson as "the fullest expression of the intellectual Celt." A writer of great imaginative penetration, a master of the magic word, he was in his younger years in London associated with such aesthetes as Dowson and Lionel Johnson in the Rhymers' Club, of which he was co-founder. Later his literary association with Lady (Isabella Augusta) Gregory (1852-1932), herself a noteworthy writer, led him to immerse himself in Irish folk lore and legend. Together with Synge, they founded the Abbey Theatre, Dublin. Yeats was one of the most significant figures of his age, and won the deference of much younger poets working in an idiom very different from his.

Not quite comparable in stature was Robert Bridges (1844-1930), who, happy in the possession of ample means, approached poetic expression very slowly, after long study of the masters. He developed an intense interest in the mechanics of prosody, working in an accentual verse system of his own devising. His work is intellectually distinguished, but difficult and lacking in warmth. On his eighty-fifth birthday in 1929 he published the long poem, *The Testament of Beauty*, which was a summing up on his lifetime's experience in philosophy and aesthetics.

Gerard Manley Hopkins (1844-89), Jesuit priest and a close friend of Bridges, occupies a peculiar but important position. Having destroyed all his work done before his

ordination in 1874, he made no attempt at publication of further poems, but sent them privately to Bridges, who published them in 1918, when their impact on the young men of that day was tremendous. Hopkins was a metrical innovator of the first order, with his own prosodic invention called "sprung rhythm," using feet ranging from one to four syllables and making skilful use of the old devices of alliteration and assonance. Cecil Day Lewis (b. 1904), himself a distinguished poet, speaks of Hopkins's "lightning dashes from image to image, so quick that we are unable at first to perceive the points of contact."

John Masefield (b. 1878) was a prolific producer of poems, plays, biographies, critical studies, miscellaneous writings, and novels of breathless speed and action. As a poet, he had his feet firmly planted on the ground, and his vocabulary was hewn out of the rock of ordinary, everyday speech. His long narrative poems, like *Reynard the Fox*, 1919, are rapid and racy, powerful and full of descriptive genius—marred occasionally by sudden lapses into a more-than-Wordsworthian bathos. Some of his sea lyrics, like *Sea Fever*, 1902, have found and merited their place in the anthologies.

Among the many and varied poetic artists of the later years, the literate public will not soon forget the names of Lascelles Abercrombie, A. E. Housman, Rupert Brooke, Wilfred Owen, James Elroy Flecker, Siegfried Sassoon, Edmund Blunden, Walter De la Mare, Gordon Bottomley. The Imagists, headed by T. E. Hulme and F. S. Flint, made their own special contribution to new modes of thought and expression. W. H. Davies (1870-1940) not only showed a delicate lyrical gift, but in his frank, rapid, meaty *Autobiography of a Super-Tramp*, 1907, wrote what is likely to remain one of the "books of the century."

Iconoclasts and Others

Iconoclasts like T. S. Eliot (b. 1888) and Dame Edith Sitwell (b. 1887) demand of their readers something like what Nietzsche called "a transvaluation of all values," or at least a complete critical reorientation. Their status remains controversial, and many readers of high intelligence find them simply unreadable. But to a large group of others Eliot, at least, has become a prophet and a pope. A writer of erudite equipment, he expressed his contempt of modern

civilization in *The Waste Land*, 1922, and became more contemplative and obscure as time went on. He also made successful excursions into poetic drama.

Edith Sitwell and her two talented brothers, Osbert (a novelist of mark) and Sacheverell (poet and miscellaneous writer), formed a combative literary pressure group in the 1920s and 1930s. Her poetry depended on verbal music and association rather than on any intellectual apprehension of the world ultimately referable to logic. It used a system of imagery that, for example, attributed sound to light and colour to sound. She had an undoubted faculty for word-music, though she demanded of her readers an abnormal mode of seeing and hearing.

The period saw an efflorescence of the essay, mostly of the Elian type, worthily maintained by such men as E. V. Lucas, A. G. Gardiner, Robert Lynd, Hilaire Belloc, G. K. Chesterton, and Max Beerbohm (1872-1956). "Max," spanning the whole period, was the most "miscellaneous" of writers, and the *beau idéal* of the witty, worldly sophisticated man of letters—novelist, parodist, essayist, caricaturist.

The field of the short story bore a rich crop. Kipling, Wells, Conrad, and Maugham (of those already named) were supreme, and almost (or often quite) of comparable level were Walter De la Mare, Oliver Onions, Algernon Blackwood, A. E. Coppard, and Rhys Davies.

Into biography Lytton Strachey (*Eminent Victorians*; *Queen Victoria*) introduced something like the novelist's technique. History produced such giants as G. M. Trevelyan and Arnold J. Toynbee; social psychology, Havelock Ellis; English literary criticism, such monumental scholars as Sir Arthur Quiller-Couch, George Saintsbury, and Oliver Elton; anthropology Sir James Frazer's *The Golden Bough*. The Near East came alive under the hands of C. M. Doughty and T. E. Lawrence.

Two lonely, unclassifiable spirits are "W. N. P. Barbellion" (Bruce Frederick Cummings, 1889-1919), who produced in *The Journal of a Disappointed Man*, 1919, a masterpiece of autobiography in diary form; and "George Orwell" (Eric Arthur Blair, 1903-50), who in 1949 published the grim and bitter *1984*, and in 1945 the gay and mocking *Animal Farm*, each in its different way a searing attack on the totalitarian state.

Herbert B. Grimsditch

Englishry. Term used in early English law. The presentment of Englishry was the offering of proof, in cases of violent death, that the person killed was an Englishman, not a Norman, as, if a Norman was killed, the community had to pay a fine. This collective punishment was abolished in the time of Edward III. The term was also used by Macaulay and others for the English settlers in Ireland.

English Setter. An elegant gundog of stable temperament and keen game sense. It has a long, lean head and deep muzzle. The ears are set on low, the nostrils are wide, the chest deep. The tail is carried in a slight curve with long hair (the flag) on its under side. The coat is slightly



English Setter. Shiplake Snowwhite, a good example of this breed

wavy, long and silky with feathered legs. Colours are black and white, lemon and white, liver and white, the tri-colour (black, white, and tan). "Freckles" over the whole body are preferred to heavy patches of colour. Height 25-27 ins., weight 60-65 lb.

English-Speaking Union OF THE COMMONWEALTH, THE. British section of a Commonwealth-American organization. Founded in 1918 by Sir Evelyn Wrench "to draw together in the bond of comradeship the English-speaking peoples of the world," it is the oldest and largest voluntary society of its kind and works in close collaboration with a sister society, the English-Speaking Union of the U.S.A. Membership in the U.K. and Commonwealth was 33,000 at the end of 1956; that of U.S. society was 24,000. It publishes the "English-Speaking World" bi-monthly; other activities include promotion of cultural activities, provision of travel grants, arranging of personal interchanges with the U.S.A. There is a residential club at the h.q., Dartmouth House, 37, Charles Street, London, W.1.

English Springer. Spaniel so-called because it springs, or flushes, game. One of the most popular and useful gundogs, it is

also one of the oldest, having been used to find game for the falcons and greyhounds of old. A compact, upstanding dog, highest on the leg of all the land spaniels, it has a head of medium length, fairly broad skull, good nostrils, long, wide ears held close to the head, tail carried low. The coat is close, weather resisting, and straight, in colour liver and white, black and white, or either of these with tan markings; height about 20 ins., weight about 50 lb.

Engraver Beetle OR BARK BEETLE (*Scolytidae*). Group of small cylindrical beetles, of which there are numerous species. Most of them burrow under the bark of trees, where the female lays her eggs in a straight tunnel from which the grubs burrow out at right angles. Most of the species are extremely destructive, causing much damage in the forests of the U.S.A. and Europe.

Engraving. (1) Art of drawing on metal or wood by means of an incised line; and (2) impression in ink obtained from such drawing on paper or similar substance. Wood engraving, which is really wood cutting, has its own entry; so also has lithography, a form of engraving on stone.

In the metal process, called *intaglio*, the lines are sunk or incised by means of a graver or burin, a steel rod four or five inches long, of square or lozenge section, with a cutting point and edges obtained by sharpening the head in an oblique section.

Plates of several different metals have been used for intaglio engraving: copper, steel, zinc, iron, silver, and even brass and pewter. Copper and steel are by far the most common. Pure copper is softer and easier to work than pure steel, but for the same reason does not wear so well under the press as the harder metal, and so does not throw off as many good impressions. The use of steel plates, though they are less duc-



English Springer. Champion specimen

tile, was developed during the 19th century on account of their greater powers of resistance, until the copper plate covered with galvanised steel was substituted for them.

The lines of an engraving on metal are often modified by the use of the etching needle, but etching, although a branch of engraving, differs from it in so many respects that it constitutes a separate art and is described separately. The line of the graver, for example, is obtained by direct pressure upon the metal, whereas the etching needle is used like a pencil, the subsequent incision being obtained by the "biting" of the acid on the plate.

There is evidence of the existence of wood-cut playing cards as early as 1440. According to Vasari (1511-74) the art of intaglio engraving was invented by Maso Finiguerra, a Florentine goldsmith and niellist, in 1460; but there is reason to believe that the art was already being practised in Italy as early as 1450; and the earliest extant intaglio engraving, a "Flagellation" belonging to a Passion series in the Berlin Museum and attributed to a master in Upper Germany, is dated 1446. But Finiguerra's work may serve as a starting point for the history of that school of Italian engravers that arose directly out of the niello workers of the 15th century. At



Engraving. Example of stippled engraving on copper of a sketch by G. Morland. Left, the copper plate on which the design was engraved. Right, the impression

first the taking of impressions from the gold and silver plates engraved according to the niello method by the goldsmith or silversmith was, doubtless, for the sake merely of checking his work; later, as the artistic value of the impression itself became evident, the scope of engraving was extended.

Among famous Italian painters of the 15th century who practised engraving were Antonio Pollaiuolo and Andrea Mantegna (*q.v.*), and Marco Antonio Raimondi, the engraver of Raphael's pictures, may be claimed as the first of the "reproductive" engravers. In Germany an illustrious school of engravers flourished in the late 15th century, including in its ranks Martin Schongauer, Albrecht Dürer, Albrecht Altdorfer, the Behams, and Heinrich Aldegrever. Line engraving was somewhat later in beginning in France, but Jean Duvet (1485-1561) and Jean Cousin (1501-89) were famous, and the French portrait engravers of the 17th century touched heights that have hardly been equalled since. In Great Britain the great artists of the 18th and early 19th centuries owe much to British "reproductive" engravers, and William Blake's work in this medium was unique.

Engrossing (Fr. *en gros*, in large). Term used by English lawyers for the copying out, in a "fair hand," of any legal document. A lawyer always makes out a draft of any important document, and has it engrossed, and the engrossment is executed by the parties concerned.

Engrossing. Word used in former days in England for what amounts to buying and selling wholesale. In other words the engrosser was a middleman. This was early regarded as an offence against law and custom, for it tended to put up the price, and various statutes declared it illegal, the chief being one of 1552. These were directed mainly against the buying and selling of corn and other foodstuffs wholesale, and the operation of the laws tended to keep these in and around the places where they were grown. As society became more specialised this was irksome, and even when the laws were in full force licences were issued allowing certain persons to buy and sell wholesale. In 1663 an Act permitted engrossing as long as the price of corn did not exceed 48s. a quarter: and in 1773 the earlier statutes against it were repealed. As an offence against the common law engrossing disappeared finally in 1844.

Enham, OR KNIGHT'S ENHAM Village of Hampshire, England 2 m. N. of Andover. In 1919 the Enham estate of 1,027 acres was taken over by the Village Centres Council for the establishment of a centre for disabled ex-servicemen after the First Great War. Living accommodation and workshops were erected for training men in furniture and boot making, carpentry, tailoring, building, painting, agriculture, horticulture, and the care of livestock and poultry. The British Red Cross made a grant of £10,000 for a medical block for the treatment of physical disabilities, and the psycho-therapeutic treatment of neurasthenic and shell-shock cases.

In 1945 a sum of £250,000 subscribed by the people of Egypt in gratitude for the battle of Alamein was set aside for the extension of the village centre to accommodate men disabled in the Second Great War. The memorial, known as Alamein village, provided for the erection of 100 houses, a medical unit, hostels, and ancillary buildings. The settlement was re-named the Enham-Alamein Centre. Its offices are at 16, Grosvenor Place, London, S.W.1.

Enharmonic (Gr. *enarmonikos*, fitting in). In music, the interval between, for example, E natural and F flat, or C sharp and D flat. Through the influence of the keyboard instruments, with their fixed twelve notes to the octave, the term often loses this meaning and is defined as "a change of name without a change of pitch."



Enharmonic. Example of enharmonic change in music

Enid. City of Oklahoma, U.S.A., the co. seat of Garfield co. It is 65 m. by rly. N. of Oklahoma and has an airport. The centre of an oil, gas, and grain producing region and of dairy and poultry farms, it has oil refineries, grain elevators, meat-packing plants, flour mills, and rly. shops. It makes drills, farm implements, wagons, lorries, glue, and gloves. The seat of Phillips university, it dates from 1893, when it was granted its city charter. Pop. (1950) 36,017.

Enigma Variations. Popular name for the Variations on an Original Theme (Enigma) for full

orchestra composed by Elgar as his opus 36 and first performed under Richter at S. James's Hall, London, June 19, 1899. The work, frequently performed in whole or in part, owes its sub-title to Elgar's statement that there runs through it another theme that is not heard. A grave, slow theme is followed by 13 variations, each given a title indicating by initials or a nickname one of the composer's "friends pictured within." All have been identified, from no. 1, the composer's wife, to the finale, which runs straight on from No. 13, and represents Elgar himself. Sensitive treatment of solo instruments and an orchestral richness mark the whole work.

Eniwetok. Atoll in the Marshall Is. (*q.v.*). Fortified by the Japanese, Eniwetok was attacked by U.S. forces in 1944. Engebe, chief island in the atoll, was seized Feb. 18, Parry I. Feb. 22; 3,000 Japanese were killed in the fighting. In 1947 Eniwetok was made into a permanent testing ground for atomic weapons, its 137 inhabitants being resettled on Ujelong, another of the Marshall Is.

Enki. Sumerian name for Ea (*q.v.*).

Enlil OR ELLIL. The high god of the Babylonian pantheon, the Semitic Bel, lord. He was god of the wind and lord of the earth, as Anu was lord of the sky and Ea of the waters. He reigned over mankind and determined mortal destinies. His temple, E-Kur, the "house of the mountain," at Nippur (*q.v.*), venerated throughout Mesopotamia, was a place of pilgrimage; a temple was built in his honour at Asshur. His consort and female counterpart, Ninlil, was later called Belit, lady.

Enlistment. Act of the individual in voluntarily contracting to render military service as a private soldier to the state. In Great Britain the form of contract is the attestation paper, which the recruit, after being accepted and passed as medically fit, signs when taking the oath of allegiance, in the presence of an officer, magistrate, or other public dignitary, who witnesses or attests the signature. The period of service in the British army is laid down in the Army Act and recruiting regulations, and is normally 12 years, which may be spent wholly with the colours or part with the colours and part in the army reserve. Recruits may choose the branch of the service they prefer, and skilled men usually select one of the specialist corps. In the line the

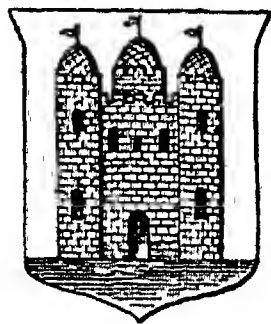
recruit may choose any regiment for which he has a preference and which is open to recruiting. He cannot then, during peace time, be transferred to another regiment, outside certain territorial groups, without his consent. By Act of parliament men may, in time of war or emergency, be compulsorily transferred from one corps to another to meet service needs. A branch of the army is detailed for recruiting duties, with an officer in charge of each district. Aliens and negroes may enlist in the British army, but cannot be promoted beyond the rank of warrant officer.

Enna. City of Sicily, Italy, capital of the prov. of Enna. On a plateau 2,615 ft. high, it has a Saracenic citadel commanding one of the best views in Sicily. Enna was captured by the Normans 1087; its cathedral was founded 1307. First mentioned in history as having been taken by Dionysius I c. 397 B.C., it took part in the last Greek revolt against Rome, and its people were massacred; in 134-132 B.C. it figured in the first great slave revolt as h.q. of the rebels. It was a centre of Demeter worship. It was the Roman Castrum Ennae, corrupted in Arabic to Kasr-Yani, whence it was long called Castro giovanni. Mussolini restored the name Enna. Pop. (1951) 27,024.

Ennerdale. Lake in W. of Cumberland, England. From it Whitehaven draws its water supply; it is 3 m. long and $\frac{1}{2}$ m. broad.

Ennis. Urban dist. and co. town of co. Clare, Irish Republic, on the Fergus river, 25 m. N.W. of Limerick by rly. Here are the Roman Catholic pro-cathedral and college of the diocese of Killaloe, and the ruins of a Franciscan abbey. Ennis has a statue of O'Connell and near by are the ruins of Clare Abbey. Furniture and bootlaces are made. Market day, Sat. Pop. (1951) 6,099.

Enniskillen OR INNISKILLING Bor., market town, and co. town of Fermanagh, N. Ireland. It stands on an island in the river between the upper and lower loughs Erne, and has suburbs on either side, with which it is connected by bridges. It has a rly. station 90 m. W.S.W. of Belfast. There are some small manufactures and a fair trade in agricultural produce. Enniskillen became a municipality



Enniskillen arms

about 1600, and was represented in the Irish parliament. From 1800 to 1885 it sent one member to the parliament of the U.K. It is chiefly famous, however, as a Protestant stronghold in the time of William III, and as giving its name (in the form Inniskilling) to two regiments of the British army, fusiliers

and dragoons. Market days, Tues. and Thurs. Pop. (1951) 6,318.

Ennius, QUINTUS (239-169 B.C.). Earliest of the great Roman poets. Born at Rudiae, in Calabria, he was not a full Roman citizen, acquiring that privilege at a later date. While serving in the Roman army in Sardinia, he attracted the notice of the elder Cato, who took him to Rome, where his knowledge of Greek and literary acquirements procured him admission to the Scipionic circle. His works embraced a wide variety of subjects, but it was as the author of some twenty tragedies and of the *Annales*, an epic of Roman history—in which, for the first time, the Latin language was moulded to the Greek hexameter—that Ennius achieved immortality. Only fragments of his works survive, chiefly in the form of quotations in later writers, especially Cicero. Some ancient critics regarded him as the equal even of Virgil, but his versification, though possessing a certain rugged dignity, is harsh compared with the finish which Latin poetry attained in the hands of Horace and Virgil.

Enns. Town and river of Austria. The town, which is 11 m. S.E. of Linz, stands just where the river falls into the Danube. An old place, it grew up around a castle built about 900. It became a free city, and was at one time a prosperous commercial place. Its chief buildings are the town hall, the castle, built in the 18th century, and a Gothic church. The river rises in the mountains near Radstadt and flows through Styria, passing through lovely mountainous scenery. Its course is east and then north. Its chief tributaries are the Salza and Steyer; its length is about 150 m.

Enoch. Name of four men in the O.T. They are a son of Cain, a grandson of Abraham, a son of



Enniskillen, Fermanagh, N. Ireland. View of the town and quays on the river connecting the upper and lower loughs Erne

Reuben, and a son of Jared. The last, the father of Methuselah, is recorded to have lived 365 years, and to have been translated without dying. He is described as being the seventh from Adam, and the Epistle of Jude (verse 14) quotes a prophecy ascribed to him.

Enoch, THE BOOK OF. One of the non-canonical O.T. Apocrypha or Pseudepigrapha (i.e. works written under an assumed name), written originally partly in Aramaic and partly in Hebrew. It incorporates fragments of the Book of Noah. The work is not a unity in any sense, and ranges from about 200 B.C. to A.D. 64. It has therefore been described as a library rather than a single book. In the words of Dr. Charles (Religious Development Between the Old and the New Testaments), "it touches upon every subject that could have arisen in the ancient schools of the prophets." These subjects include the origin of evil, the millennium, the Messiah, the future life, and even the Hebrew calendar. The book seems to have had a considerable influence on N.T. theology. See Apocrypha.

Enoch, BOOK OF THE SECRETS OF. A book belonging to the same category as the Book of Enoch (v.s.). Dr. Charles describes this book as 2 Enoch and the Book of Enoch as 1 Enoch. The work, preserved only in Slavonic, seems to have been written by a Hellenistic Jew in Egypt at about the beginning of the Christian era. It is related in some way to a Hebrew book referred to in Jewish literature (in the Zohar) as "the Book of Enoch" and the "Book of the Secrets of Enoch." The writer is orthodox, but at the same time so broad-minded as to adopt into his philosophical system Platonic, Egyptian, and Zend elements. The book describes Enoch's ascension and voyage through the seven heavens.

Enoch Arden. Narrative poem in blank verse by Tennyson, written in 1862 and published two years later. It tells of a seaman who travels abroad, is wrecked, and after years without communication comes home to learn that his wife has married again. There are beautiful descriptive passages, and a quiet emphasis, characteristic of the poet, on change and loss as elements in life.

Ensa. Popular name for Entertainments National Service Association, formed in 1939 by Basil Dean to provide entertainment for personnel of the British services. Ensa had its headquarters at the Theatre Royal, Drury Lane, London, and assumed responsibility for entertaining troops at home and overseas, being sponsored by the Navy, Army, and Air Force Institutes. Its activities included variety, concerts, drama, broadcasting, and cinema shows. On Nov. 12, 1939, the first concert was given to the B.E.F. in France, and up to June, 1940, over 5,500 entertainments were given in that country and attended by 2,242,559 persons.

In Great Britain each command was allotted about 20 parties giving 150 performances a week. From July, 1940, to Jan., 1942, audiences totalled 50,000,000. During 1942-43 Ensa parties were transported to and from 22,000 locations, travelling some 2,000,000 miles. They toured in North Africa, the Middle East, Italy, Iceland, and India. In 1944, 30,000 cinema shows and 12,000 stage performances drew nearly 20,000,000 people. The total expenditure of Ensa, excluding India and Burma, was almost £15,000,000.

India had its Ensa, although, owing to the long distances to be travelled, units were encouraged to provide their own entertainment. In Burma the first shows were given in March, 1944, on the Imphal sector; on the Chindwin performances were under an armed guard, lest a Japanese patrol should attack. By Jan., 1945, ten concert parties, five dramatic companies, and a pool of artists were operating in India, Ceylon, and Burma. Troops isolated in Waziristan, Persia, Iraq, and Tanganyika were visited by Ensa parties. In N.W. Europe, during the long, bitterly cold winter of 1944-45, Ensa sometimes

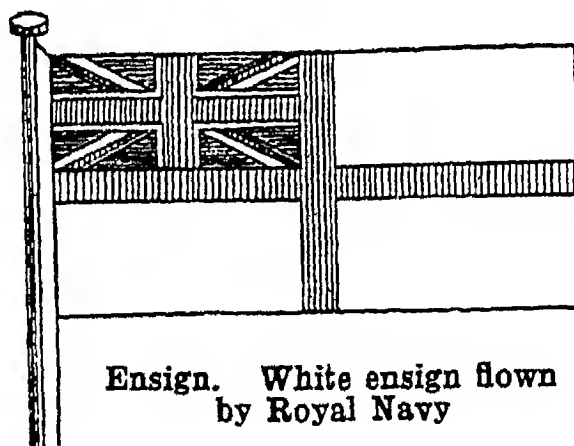
performed in lavishly equipped theatres in base areas, more often in half-demolished buildings close to the front line. Rediffusion vans, equipped with libraries of 500 records, visited troops in out-of-the-way localities.

At home Ensa artists provided entertainments for British and Allied forces and civilian war workers throughout the country until March, 1946. Ensa was succeeded by Combined Services Entertainment, which provided for every soldier a cinema show at least once a week and a live performance every five weeks; it was disbanded on Aug. 31, 1946. Consult *The Theatre at War*, Basil Dean, 1956.

Enschede. Town of the Netherlands, in the province of Overijssel. It is 29 m. E.N.E. of Zutphen. A seat of the cotton-spinning and weaving industries, Enschede is also a railway junction. It was severely damaged by a conflagration in 1862. The British 11th armoured division liberated it from the Germans in the Second Great War, April 2, 1945. Pop. (1955) 115,227.

Ensemble (Lat. *in simul*, at the same time; Fr., together). In music, something which is considered as a whole, or with all the parts taken together, e.g. the united performance of all voices or instruments engaged in rendering a piece of concerted music, like a quartet or quintet; the united performance of an orchestra or chorus; the total effect of such performance. By extension the term is applied to a theatrical performance, including scenery, costumes, etc.

Ensign. Flag which a ship carries astern to indicate her nationality. Each country has separate



Ensign. White ensign flown by Royal Navy

ensigns for its navy and its mercantile marine. Great Britain has three, allocated since 1864 as follows: the white ensign is flown only by ships of the Royal Navy and vessels of the Royal Yacht Squadron; the blue ensign is the flag of the Royal Naval Reserve; and the red ensign is the flag of the merchant service. The

earliest date on which the St. George's cross, the forerunner of the white ensign, was flown by English admirals was in the Cadiz expedition of 1596. The Royal Air Force ensign consists of a sky-blue ground with the union flag in the jack and the R.A.F. red, white and blue roundel in the fly. The civilian ensign is also of sky-blue ground with the union flag in the jack; it carries in addition a dark blue cross edged with white. War department vessels fly a blue ensign with crossed swords in the fly. When a ship flies her ensign upside down it denotes that she is in distress. *Pron.* Ens'n. See Flag.

Ensign. Rank in the British army, now obsolete. It was given to an officer of the infantry on first being commissioned, and it was his duty to carry and guard the regimental colours, both on parade and in the field. The corresponding rank in the cavalry was cornet, and both were discarded in 1871 when the purchase of commissions was abolished, the rank of second-lieutenant being substituted. Ensign is a rank in the United States navy held by the lowest grade of officer and equivalent to midshipman in the Royal Navy. *Pron.* En'-sine.

Ensilage. Food for farm livestock produced by preserving fodder crops in a green, succulent condition for use at a later date. When the cost of labour in the production of root crops was low, the practice of ensiling fodder material did not receive much attention in Great Britain; now with greatly increased labour costs the practice is general. Crops best suited for ensiling are mixtures of oats and tares, oats and peas on light land, and oats, beans, and tares on heavy land. Tares and peas require a plant such as oats to support them and prevent their becoming fouled with soil in wet weather. But any green, succulent vegetable material can be ensiled; and in weather unfavourable for hay-making, grass is frequently used. In the U.S.A. green maize, sorghum, and sunflowers are commonly grown for ensilage.

The three methods by which ensilage is made are siloing, clamping, and stacking. The silo is a building of timber, concrete, etc., frequently taking the form of a tower 30 or more feet high. The silage crop is gathered in a green condition, cut into small lengths, blown into the top of the silo, and distributed and consolidated by hand. Silos of

this description involve substantial capital outlay but are free from the waste occurring in clamping or stacking. Clamping consists of dumping the green crop straight from the field into an excavated space 1-3 ft. deep. Consolidation is provided by the filled carts which are drawn over the top of the clamp as it is formed. Earth is then piled against the sides and on top of the heap to maintain compactness and exclude the air. Silage stacks, built at any convenient position in a field, are formed of the green crop carted straight from the field after cutting.

The material resulting from the three methods of preparation is described as "sweet" or "sour." Sweet silage has a pleasant smell like that of slightly heated hay; it is usually dry, light brown in colour, and gives rise to lactic acid; livestock eat it readily. Sour silage is much darker in colour and possesses an unpleasant odour due mainly to butyric acid. The differences in the two forms arise from the method of making: sweet silage is produced in the presence of a liberal supply of air, and in the early stages the temperature rises to as much as 50° C.; but in sour silage the amount of air circulating in the heap is limited, and the chemical changes involved are in part putrefactive and brought about largely at the expense of protein.

Ensor, BARON JAMES (1860-1949). Belgian painter. The son of an English father and a Flemish mother, he was born April 13, 1860, at Ostend, where, except for three years at the Brussels academy, 1877-1880, he spent his life. In 1930 he adopted Belgian nationality, and was created a baron. When Belgian art was foundering in a realism that was by turns affected, sentimental, and vulgar, Ensor's work had a great influence not only in his adopted country, but upon all European art. Recognition, however, was slow, and not until 1929 was Ensor's reputation established with a retrospective exhibition in Brussels. The element of fantasy which distinguished much of his subject matter was at its best in such works as *Skeletons*, *Warming Themselves*, and *The Battle of the Golden Spurs*. Exhibitions of his work were held at the Leicester Galleries, 1936, and the National Gallery, 1946. He died Nov. 19, 1949.

Ensor, SIR ROBERT CHARLES KIRKWOOD (b. 1877). British historian. Born Oct. 16, 1877, he was educated at Winchester and

Balliol College, Oxford, and was called to the bar in 1905. A leader writer on the *Manchester Guardian*, 1902-04, and the *Daily News*, 1909-11, he was chief leader writer on the *Daily Chronicle*, 1912-30. Deputy for the Gladstone professor of political theory and institutions at Oxford, 1933 and 1940-44, he became a research lecturer at All Souls. His publications include *Modern Socialism*, 1903; *Columbus*, 1925; *Courts and Judges*, 1933; *England, 1870-1914*, 1936; *A Miniature History of the War*, 1945. He was knighted in 1955.

Enstatite. A common rock-forming mineral. One of the pyroxene group, it crystallises in the orthorhombic system, in stout prismatic crystals. Chemically essentially a metasilicate of magnesium, it occurs in the intermediate and basic igneous rocks, low in lime content, also in derived serpentines and, less commonly, in metamorphic rocks. It is often found in parallel growth with a monoclinic pyroxene. It is a common constituent of metallic and stony meteorites.

Entablature. Term in architecture signifying the combination of architrave, frieze, and cornice at the summit of a building. In early Greek architecture the entablature, like the supporting column, was frequently of wood; and there is evidence to show that it was constructed of this material for some time after wooden columns had been replaced by stone or marble. In the Greek towns of S. Italy wooden entablatures upon stone columns are known to have been in use for several centuries. The entablature is necessarily a prominent feature of the classic or horizontal styles of architecture, rather than of the Gothic or vertical styles; but its principle is universal. The original meaning of the word was a board work or flooring (Lat. *tabula*, plank). See *Architecture*; *Cornice*.

Entail. The settling of an estate on a man and the heirs of his body. In feudal times land was granted to a man and his heirs in tail male or tail general, the idea being that if an heir failed it would revert to the king or lord who granted it. In time, however, the practice grew up of regarding it as a free estate as soon as an heir was born, thus depriving the grantor of his rights. The statute De Donis Conditionalibus of Edward I put an end to this practice, but only for a time, as legal fictions for evading it were in-

vented. The entailed estates of to day are simply settled estates, but they can be settled only on living persons and a period of 21 years beyond. In 1926 entails ceased to be legal estates and are now equitable interests, more properly called entailed interests.

Entamoeba. Any member of a group of protozoa parasitic within some host, usually in the gut. Various species cause disease.

Entebbe. Administrative capital of the Uganda protectorate, British E. Africa. On a promontory to the west of Murchison Bay in Lake Victoria, it is an important air transport centre, and is also connected with Kisumu and other lake harbours by steamer.

Entente Cordiale (Fr., cordial understanding). Name given to a series of agreements signed in London on April 8, 1904, by the 5th marquess of Lansdowne on behalf of the U.K. and Théophile Delcassé on behalf of France. They settled various matters long in dispute between the two countries, among them fishing rights off Newfoundland; set up a condominium in the New Hebrides; and recognized as predominant British interests in Egypt, French interests in Morocco. The two signatories and Paul Cambon, French ambassador in London, played the chief part in bringing about the agreements; but the popularity won by Edward VII when he visited Paris officially in 1903 helped the negotiations.

Enteric Fever. See *Typhoid*.

Enteritis (Gr. *enteron*, intestine). Inflammation of the mucous membrane of the intestine. The condition may be due to eating unsuitable or unsound food, such as unripe fruit or decomposing meat, or to irritant poisoning by arsenic, mercury, and other substances. Secondary enteritis is a symptom of many diseases, particularly cholera, dysentery, and typhoid fever.

The prominent characteristics are abdominal pain, severe diarrhoea, and sometimes blood in the evacuations. In severe cases ulceration of the intestine may be followed by perforation and fatal peritonitis. Epidemic enteritis, or "summer diarrhoea," can be a fatal disease among infants under one year of age, in large towns sometimes accounting for one-fifth of the total infant mortality. The disease is most prevalent in hot, dry weather, the dust blown up from dirty streets and refuse heaps being an important causative

factor. Treatment should deal with the essential cause and with the diarrhoea.

Enteroptosis (Gr. *enteron*, intestine; *ptōsis*, falling). General downward displacement of the abdominal organs, in particular the stomach and intestines. The condition develops gradually, and is more frequent in women than in men, encouraged possibly by the stretching of childbirth or by the greater width of woman between the pelvic bones. Enteroptosis is often found in association with neurasthenia; a highly strung nervous system is more aware of the discomfort caused by the pull of the displaced organs, and, conversely, the displaced organs exercise a malign influence on the system. Massage, electricity, and physical exercises improve the tone of the slack abdominal muscles, and distress is often relieved by the wearing of a belt so designed as to support the sagging structures.

Enterprise. British steamship, the first to make the passage between Great Britain and India. She left London Aug. 16, 1825, and reached Calcutta on Dec. 7. The Enterprise, which was a paddle steamer, displaced 480 tons and had engines of 120 h.p. She was also the first steamship to double the Cape.

Entertainment Duty. Duty levied in the U.K. on charges for admission to entertainments. Introduced in 1916, it originally applied with a few exceptions to almost all entertainments, defined as including exhibitions, performances, amusements, games, or sports. The duty was for long attacked because it was payable regardless of whether the entertainment was making a profit or a loss and particularly because of the burden it imposed on cultural activities such as the "live" theatre and on sports. In consequence there were many relaxations; these proceeded to some extent on the principle that "live" entertainments, i.e. those such as a stage play at which the performers are personally present—should pay a lower rate of duty than "canned" entertainments—e.g. the cinema. Thus in 1935 a lower scale was introduced for theatres, concerts, circuses, and some similar entertainments, and the list was enlarged in 1946 to include many sports. In 1952 an intermediate scale was introduced for sports. In 1953 all cricket matches and amateur games and sports were exempted.

and the budget of 1957 proposed in effect to abolish the duty on all entertainments except cinemas. The highest yield of the duty was £53½ million in 1946-47; the yield in 1957-58 was expected to be about £29½ million (the cinema having always borne the greater part of the duty).

The rate of duty varied with the price of admittance and was altered from time to time in the budget. There were many exemptions—from 1957 of lesser importance—for entertainments given for charity or other special purposes.

Enticement. Term in law. Anyone who induces a wife to leave her husband so that he loses her "comfort and society" may be sued by the husband for damages for enticement. In 1923 it was decided that a wife has a similar remedy against anyone who induces her husband to leave her. It is not necessary that the wife or husband should have committed adultery with the enticer.

Entombment. Literally a burial. In a special sense, however, it is applied to the burial of Jesus Christ, and as such is the subject of several notable paintings. The most famous of these are one by Raphael, in the Borghese Palace at Rome, one by Titian in the Louvre, and one by Caravaggio, in the Vatican.

Entomology (Gr. *entomon*, insect; *logos*, science). Branch of zoology which deals with insects. The offices of the Royal Entomological Society of London are at 41, Queen's Gate, S.W.7. The Imperial Institute of Entomology is housed at the Natural History Museum, London, S.W.7. See Insects.

Entomostraca (Gr. *entomon*, insect; *ostrakon*, shell). One of the divisions into which crustacea (*q.v.*) are divided. It includes the lower forms of crustaceans.

Entozoa (Gr. *entos*, within; *zōon*, animal). The name given to parasitical forms which live in the interior of the body of their host. Examples are the tape worm and flukes. They are opposed, therefore, to the ectozoa, which live on the exterior. See Parasite.

Entr'acte (Fr. *entre*, between; *acte*, act). Short piece of music played by the orchestra between the acts or scenes of a play. It is generally of a suave and melodious character. Sometimes, in a musical play, it consists of the development of a melody or *leitmotiv* embodied in the work; sometimes of an independent piece.

Entrecasteaux, JOSEPH ANTOINE BRUNID' (1739-93). French sailor. A native of Provence, he entered the navy. He commanded a ship in the war against Britain, but his great work was as a discoverer. As commander of the French fleet in the E. Indies, he visited China; he was also governor of Mauritius and the Île de Bourbon. He sailed into the South Seas and made several discoveries therein, a strait, a point, and a group of islands commemorating his name (see D'Entrecasteaux). He was in the East when he died, July 20, 1793.

Entre Minho e Douro. Name of a former province of N.W. Portugal. It lay between the Minho and Douro rivers, facing the Atlantic. Mountainous and well watered, the area has a mild climate, and produces maize, wine, oil, fruit, and nuts, while palms and fuchsias thrive. Cattle and pigs are reared, timber is cut on the mts., and fish abound in the rivers. Though implements are primitive, agriculture flourishes. The roads are bad; ox-traction is the chief form of transport. The Oporto-Corunna rly. runs near the coast. This most densely populated part of Portugal was in 1947 divided into the provinces of Minho, Trás-os-Montes e Alto Douro, and Douro Litoral.

Entrenchment. Military term for an excavated position protecting troops in attack or defence. Entrenchments became necessary with the development of firearms, and were first used on a large scale by the Turks in the 15th century. The fire-power of machine-guns and the use of shrapnel and high explosive, combined with the vulnerability of infantry, necessitated large-scale development of entrenched warfare during the First Great War. It continued until the introduction of tanks. The mobile armoured operations of the Second Great War rendered permanent entrenchments obsolete, and such forms of defence were restricted to slit trenches and fox-holes for the temporary protection of advancing infantry held up by air or artillery attack.

Entrepreneur (Fr. *entre*, between; *prendre*, to take). Word used for one who brings capital and labour together. Employing them as he thinks best, he pays interest to the one and wages to the other, keeping any balance of profit for himself. The old theory of economics that the partners in industry were the

landowner, the capitalist, and the labourer left out of account the fact that in large undertakings the directing brain often belonged to none of these classes. He was simply one who hired the others, and the word *entrepreneur* was invented to describe him.

Entre Rios (Span., between rivers). Prov. of N.E. Argentina, occupying the angle between the Paraná and Uruguay rivers. The surface is low, alternating between swamps and prairies, while in the N. it is heavily forested and furnishes wood for building and cabinet-making. Cattle, sheep, and horses are raised by the million, and, together with hides, horns, and other animal products, are exported. Cereals, wine, and lucerne are grown. The prov., capital Paraná, has a healthy climate, and, traversed by several rlys. and waterways, it is one of the most prosperous in the republic. Area 30,243 sq. m. Pop. (est.) 918,000.

Entre Rios. Town of Brazil, in the state of Rio de Janeiro. It is about 50 m. by rly. N. of Rio de Janeiro, in a coffee-producing district. There is another Brazilian town of this name in the state of Goyaz, 45 m. N.W. of San José.

Entropy (Gr. *entropē*, turning in). An important concept in the theory of heat engines and the science of thermodynamics. The entropy of a substance is a quantity which increases with any increase in the total heat of the substance and likewise decreases with any decrease in the total heat. The change of entropy is measured by the change in the quantity of heat divided by the absolute temperature at which this change takes place. Thus the entropy of a system under what are known as adiabatic conditions, where heat neither enters nor leaves the system, is constant.

Where heat simply flows from a hot body to a cold one, the loss of entropy by the hot body is more than made up by the gain of entropy by the cold body, so that there is a net gain of entropy on the whole. In a heat engine, heat flows from a hot body to a cold one, but in the process some of the heat disappears, being converted into work. With a theoretical engine of maximum efficiency, there would be no change of entropy due to this process, but no actual engine succeeds in converting as much of the heat into work as the theoretically perfect engine, and the effect of an actual heat engine is a net gain of entropy.

As heat is everywhere flowing from hot bodies to cold ones, the entropy of the universe as a whole is continually increasing, and is often said to be tending towards a maximum. In such an imaginary condition of maximum entropy there would be no motion, all the existent energy of the universe would be converted into heat, and the whole would stagnate at a uniform temperature. In the earth's atmosphere entropy increases slightly from the surface until the base of the stratosphere is reached; thence entropy increases rapidly with height. Meteorologically the condition of any level of the atmosphere at a given time is defined by a statement of its entropy, its temperature, and its water vapour content. See Carnot's Cycle; Energy; Thermodynamics.

Enurēsis (Gr. *en*, in; *ourein*, to urinate). Involuntary discharge of the urine. It is commonly seen in young children who have not acquired full control over the bladder. If it occurs at night, it is known as nocturia. It may be due to irritation of the bladder walls by acid urine or by a polypus, or to the presence of worms in the rectum. The condition is associated with some forms of paralysis. If a case persists, threats of punishment may do much harm, as the underlying cause may be a psychological maladjustment needing skilled treatment.

Envelope. Gas bag of an airship, or, in a rigid airship, the whole body of the vessel within which the gas bags are housed. Gas bags are made of skin or fabric, and the outer envelope of the rigid airship is a stouter fabric, rubberised or otherwise treated so as to resist absorption of moisture and the effects of weather. See Airship.

Enver Pasha (c. 1882-1922). Turkish soldier and politician. Born at Apana, on the Black Sea, of humble parentage, he entered the Turkish army in 1896. He first came into notice in connexion with the Young Turk movement in 1905 at Salonica, and later joined the revolutionaries who, in July, 1908, captured Monastir, where a constitution, accepted by the sultan Abdul Hamid, was proclaimed. Enver soon afterwards was appointed military attaché at Berlin, but on the outbreak of the Turkish counter-revolution in March, 1909, he returned to Salonica, and assisted in the deposition of Abdul Hamid.

Enver then went back to Berlin, and in 1910 paid a visit to

London. In 1911 he organized the Arabs of Tripoli against the Italians in the Tripoli War.



Enver Pasha,
Turkish soldier

In the second Balkan War he recaptured Adrianople from the Bulgarians in July, 1913. Shortly before, he had become minister of war with the rank of pasha, and married one of the imperial princesses. One of the leading spirits of the Committee of Union and Progress, the central organization of the Young Turks, he was personally pro-German, his influence being one of the factors that brought Turkey into the First Great War against the Entente. After the submission of Turkey in 1918 Enver fled to the Caucasus. He encouraged the Turks in their resistance to the terms of the peace treaty in 1920. He was killed in Bukhara, Aug. 4, 1922.

Environment (Fr. *environ*, around). Biological term for the sum total of all the conditions, agencies, and influences which affect the development, growth, life, and death of an organism, species, or race. Various theories of evolution have maintained, on the one hand, that variations in animals and plants arise fortuitously, and may fit the organism for life in particular environments; on the other hand, that environment itself produces modification in the living organism. In the absence of adaptation to environment, no organism could live and reproduce itself, and the ultimate object of a living creature must be reproduction. The term is usually understood to refer to physical, chemical, or material agencies. With reference to highly evolved animals it includes, in its widest sense, mental influences, so that it may be said that each individual lives in an environment consisting of physical, mental, and, for man, spiritual parts. In education and psychology, the perennial argument whether heredity or environment (nature or nurture) plays the more important part in an individual's mental development remains unresolved, most eugenicists claiming the former and many educationists the latter as the more potent influence. See Ecology; Eugenics; Evolution; Heredity.

Envoy (Fr. *envoyer*, to send). Term used for one sent to a diplomatic errand. It is more general

than ambassador, being used for persons who go on temporary missions to foreign courts as well as for more permanent officials. The former are described as envoys; the latter are envoys extraordinary, and include ambassadors. See Diplomacy.

Enzyme (Gr. *en*, in; *zymē*, leaven). A complex organic substance formed by living cells. Often described as biochemical catalysts, enzymes are classified according to their properties, their chemistry not being fully understood. They exist in the colloidal state, and may be rapidly inactivated when heated in the presence of moisture.

Enzymes play a part in industrial processes such as brewing, baking, and cheese making, and as laboratory agents in pharmacy. The most familiar example of their action is the fermentation of sugar by yeast, a minute unicellular organism. Yeast cells contain an enzyme which converts sugar into alcohol and carbonic acid gas. Enzymes help, too, in the digestion of food. Ptyalin, secreted by the salivary cells, converts cooked starch into dextrin and maltose; pepsin, secreted by cells in the stomach, changes protein to proteoses and peptones; and enzymes in the pancreatic juice convert fat into simpler bodies. The souring of milk and the decomposition of meat by bacteria are other instances of enzymic change.

It is suggested that consciousness in some way depends on enzyme action in the brain cells; that unconsciousness resulting from an anaesthetic depends upon a cessation of their enzyme life. Enzymes are vitally necessary to every chemical process involved in respiration, and are connected with the action of many poisons and anaesthetics.

Eoanthropus dawsoni. Name, derived from Greek *ēōs*, dawn, *anthropos*, man, and the surname Dawson, which was given to remains allegedly "discovered" in 1912 by Charles Dawson (d. 1916), an amateur anthropologist, at Piltdown, Sussex, and long thought to be genuine. Investigations carried out in 1953 proved that the remains were genuine cranial fossil fragments with the faked jaw of a modern ape. See Man: Piltdown Skull.

Eocene (Gr. *ēōs*, dawn; *kainos*, recent). Name given to the earliest part of the Tertiary period, when stratified rocks, the eocene system, were being formed. It followed the

Cretaceous period, the strata of both ages merging gradually in S. Europe, America, and New Zealand. In W. Europe, at the end of the Cretaceous period, great geographical changes were in progress; consequently there is a sharp line of demarcation between the two sets of strata. Eocene beds usually rest on eroded surface of chalk. Eocene rocks of W. Europe are usually soft sands and clays, with some limestone and marl; all were laid down in local basins under marine, brackish, or fresh-water conditions. In S. Europe, Caucasus, Asia Minor, N. Africa, through Persia towards China and Japan, great thickness (several thousand feet) of limestone developed, made up in places largely of the fossilised shells of large disk-shaped foraminifera (nummulites). Volcanoes were active in eocene times, old lavas and other forms of rock being found in Antrim, Inner Hebrides, Apennines, Western U.S.A., etc.

The forerunners of nearly all kinds of animals now living appeared in eocene times. The early ancestors of the horse had then five toes; small, pig-like, marsh-dwelling animals in Africa represented the original stock from which elephants came. Placental mammals appeared in great numbers. Crocodiles and toothed birds lived in a sub-tropical estuary where London now stands. Important areas of eocene deposits are known as London, Hampshire, and Paris basins. Various beds in the London basin, in order of succession, are Thanet Sands (at base), Woolwich and Reading Beds, Blackheath Pebble Bed, London Clay, Bagshot Sands; total thickness about 970 ft. Those of the Hampshire basin are much thicker, and slightly different: no Thanet Sands at base, great development of Barton Beds at top, and Brocklesham and Bournemouth Beds in the middle.

Eolian Deposits. This term in mineralogy is also spelt Aeolian and is so listed in this work.

Eolis. Small nudibranch mollusc. It has no shell and no true ctenidia. It has secondary gills and is marine.

Eolith (Gr. *ēōs*, dawn; *lithos*, stone). Stone implement earlier than those of the Palaeolithic age. The Lower Palaeolithic handaxes had presumably a long antecedent history, back to the time when primeval man first used unwrought stones as tools. The so-called eoliths, flints that might be primitive tools, have been collected from Tertiary rocks in Kent, Portugal,

France, and elsewhere; but it has still not been proved that they are worked flints. The rostro-carinate flints found in Pre-Crag levels in East Anglia were accepted by archaeologists, after long dispute, as human artefacts, and as evidence for pre-Palaeolithic man; but these flints differ in type from the stones called eoliths.

Eon de Beaumont, CHARLES GENEVIÈVE LOUISE D' (1728-1810). French diplomat. Born



Eon de Beaumont, French diplomat

in Burgundy, Oct. 5, 1728, he entered the army in 1755, and in 1757, having attracted the attention of Louis XV, was sent, disguised as a woman, on a diplomatic mission to Russia. In 1762 he came to England, where in a fit of pique he published certain libels for which he was convicted in 1764 and outlawed. The question of his sex had aroused such controversy that heavy bets were made and gambling policies of assurance effected. General opinion declared him a woman, and Eon took no steps to decide the matter. He returned in 1777 to France, where he lived as a woman, but came back to England in 1785, and ten years later, having lost everything in the French Revolution, dressed as a woman he gave an exhibition of fencing in London, where he died, May 21, 1810. A post-mortem examination showed masculine characteristics.

Eos. In Greek mythology, goddess of the morning. She is identified with the Latin Aurora (*q.v.*).

Eosin. Scarlet-coloured aniline dye prepared by the action of bromine upon fluorescein. It occurs as dark brown crystals with a green metallic lustre, different strengths and shades of colour being distinguished commercially by the addition of letters, *e.g.* A, GGF, DH. It is used to make red ink, as a dye for fabrics, paper, and cosmetics, and as a stain in microscopy. See Dyes.

Eöthen (Gr., from the East). Travel book by A. W. Kinglake, first published in 1844 with the full title of Eöthen; or Travels Brought Home from the East. A most engaging book, it describes the author's journeyings from Belgrade to Constantinople and Cairo, and through Palestine.

Eötvös, JOZSEF, BARON (1813–71). Hungarian novelist and statesman. He was born Sept. 3, 1813, at Buda, and educated at the university there. After travelling extensively in Western Europe, he returned to Hungary, and in 1838 produced his novel *The Carthusian*, a sentimental study of a wealthy young French count who retires from the world and becomes a monk. His second novel, *The Village Notary*, 1846, is an attack upon serfdom and other evils. His *Hungary in 1514*, an historical romance describing the great peasant rising under Dozsa, and the terrible vengeance taken by the nobles, appeared in 1847. *The Influence of the Leading Ideas of the Nineteenth Century upon the State* (1850–54) is an attempt to show how far it is possible fully to realize the doctrines of liberty, fraternity, and equality. Eötvös was twice minister of public instruction, in the first Hungarian ministry of 1848 and in the Andrassy ministry of 1867, and set up a system of national education. He died Feb. 2, 1871.

Eozoon (Gr. *ēōs*, dawn; *zōon*, animal). Name given to mineral structure, consisting of thin wavy layers of white calcite and green silicate (serpentine), curiously intergrown, and resembling structures of certain lowly organisms. Found in the pre-Cambrian rocks in Canada, it was formerly regarded as of organic origin.

Epacris (Gr. *epi*, on; *akris*, top). Genus of shrubs of the family Epacridaceae. Natives of Australasia, they have scattered leaves and abundant, cylindrical, bell-shaped flowers produced singly from the axil of a leaf. They are largely grown in European greenhouses, and many varieties and hybrids have been produced. A few species have edible berries.



Epacris nivalis, a greenhouse plant from Australia

Epact (Gr. *epaktos*, brought on, added). Number of days in the moon's age on Jan. 1. The excess of the solar year over the lunar is about 11 days. Should a new moon fall on Jan. 1, the epact of the ensuing year would be zero or 0. On Jan. 1 of the calendar year following the epact would be 11. The number is increased accordingly until, at the end of the lunar cycle, 19 years, the moon's aspects begin to be repeated. As the

moon's age cannot exceed 30 days, the epacts 0, 11, 22, are followed by 3. The epact was formerly used in calculating the date of Easter. See Calendar; Chronology; Lunar Cycle; Solar Cycle.

Epaminondas (c. 418–362 B.C.). Theban general and statesman. Although of aristocratic family, his early life was spent in poverty. He first came forward as a man of outstanding ability at the battle of Leuctra (371), when he was chiefly responsible for the great defeat inflicted on the Spartans which brought to an end the Spartan hegemony over Greece. Epaminondas determined to follow up his victory and to break the power of Sparta in Peloponnesus, her particular stronghold. With this object, he united the cities of Arcadia in a league, with the new city of Megalopolis, founded by himself, as the capital. As part of the same policy, Messenia, which had been for three centuries under the heel of Sparta, was made into an independent state. Dissension, however, arose in the new Arcadian league, some of its members inclining towards Sparta. In 362 the Spartans sent an army into Arcadia, which was defeated at the battle of Mantinea, but Epaminondas fell in the battle. During his lifetime, Epaminondas had raised Thebes to be the leading power of Greece, but its hegemony did not last after his death.

Epaulette (Fr., little shoulder). Fringed shoulder piece worn on full dress uniform by officers of the Royal Navy and on the great-coats of Royal Air Force officers and bearing the markings indicating rank. British naval epaulettes are of gold bullion with a fringe, and R.A.F. epaulettes are of cloth. Epaulettes were formerly worn by all ranks of the British army, but in 1855 they were abolished except for general officers' full dress uniform and for tropical uniform. They are worn by all ranks in certain foreign armies. The epaulette is a survival of the epaulière or metal shoulder-plate of medieval armour.

Épée (Fr., sword). French duelling and fencing sword. It weighs 1½ lb. and has a triangular blade 35 ins. long. It has no cutting edge and is used for thrusting only. The grip is 8 ins. long and is protected by a circular guard or shell. The

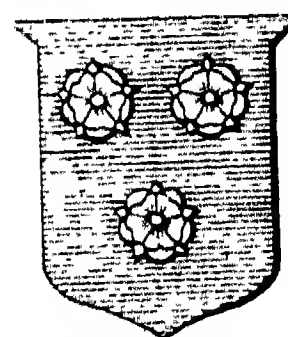
épée was first used in English fencing in 1900. It has given its name to a thrust or point in that sport. See Fencing.

Epéhy. Small town of France, in the dept. of Somme, 13 m. S.E. of Cambrai. Pop. (1954) 1,232.

It was among places that figured prominently in the campaigns of the First Great War, being captured from the Germans by the British, April 1, 1917, and becoming the scene of heavy fighting in the German counter-attack after the battle of Cambrai, Nov., 1917. Retaken by the Germans early in their great final offensive of March, 1918, it fell to the British in Sept., 1918, in the so-called battle of Epéhy.

The Hindenburg Line lay little more than a mile to the E., and it was during the final Allied advance to that line that the battle developed. After initial operations to N. and S., the main attack, covered by a creeping barrage, was launched on Sept. 18 in heavy rain, by British troops of the 3rd and 4th armies, the Australian corps, and a corps of the 1st French army, on a front of over 25 m. By Sept. 25, after continuous heavy fighting and many casualties, all ground and positions needed for the Allied attack on the Hindenburg Line had been secured. The Australians had particularly distinguished themselves, breaking through an extent of 5,000 yds. of German front on the first day, and establishing themselves in the outer defences of the Hindenburg Line. German prisoners in the British section of the front numbered 11,750, and 100 guns were captured. In all, 14 British divisions opposed 15 German. The British success was the more notable in that the troops had been fighting almost continuously for seven weeks, suffering 72,000 casualties in that time.

Épernay. Town of France, in the dept. of Marne, about 19 m. W.N.W. of Châlons-sur-Marne.



Épernay arms

Important industries include spinning, tanning, cork and cask making, and brewing, but above all the champagne industry, the wine being stored in cellars hollowed out of the chalk rock. In normal times about five million bottles are laid down annually. The town was occupied by the Germans early in the First Great War, and was one of the German objectives in the

second battle of the Marne, July, 1918, when the assistance of the British divisions, Yorkshiremen and Highlanders, in the defence of Épernay, was specially recognized by Gen. Berthelot. Pop. (1954) 21,222. See Marne. Battles of the.

Ephah. In the O.T., name for the first in order of the sons of Midian (Gen. 25; 1 Chron. 1; Isaiah 60); concubine of Caleb in the line of Judah (1 Chron. 2); son of Jahdai (1 Chron. 2). The word, of Egyptian origin, was adopted as the name of a Hebrew dry measure which corresponded to the *bath* in liquid measure.

Ephedra. Genus of herbs. Under the name Ma Huang (astrigent yellow), species of ephedra herb have been used as a medicine in China since ancient times. The genus belongs to the joint-fir family of gymnosperms, distinct species being distributed in the temperate and subtropical latitudes of Europe, Asia, and America, growing especially well in N. China, N. India, and Spain. The plants are mostly low, much branched, often procumbent, occasionally climbing shrubs, the green stems being collected for medicinal use. The chief constituents of ephedra are the alkaloids ephedrine and pseudo-ephedrine.

Ephedrine. Alkaloidal active principle ($C_{10}H_{15}ON$) present in various species of ephedra. A synthetic preparation was evolved in 1927. It has a physiological action resembling that of adrenalin (*q.v.*), to which it is closely related chemically. Although isolated in pure form by the Japanese chemist Nagai in 1887, not until 1923, through the work of Chen and Schmidt, was the possible value of ephedrine as a therapeutic agent recognized and the substance made available for general use in the therapy of allergic diseases. Ephedrine has a more prolonged action than adrenalin and has the great advantage of being effective when given by mouth.

Ephemera OR MAY FLY (Order Ephemeroptera: Gr. *ephemeros*, living a day; *pteron*, a wing). Insect with long slender abdomen, ending usually in three long bristle-like cerci. The eyes are large, antennae short, and the wings membranous and net-veined. The mouth-parts are aborted, no food being taken in the adult stage. The nymphs are all aquatic, breathing by lateral gills. The perfect insects are common about May; many kinds live but a few hours, and others survive days in favourable weather. About 40 species are

British. Fish rise readily to seize certain species, and at the time of the May fly anglers expect to secure exceptional catches by the use of fisherman's flies made in imitation of the natural creature.

Ephemerides (Gr. journals). Astronomical tables showing the predicted positions of a heavenly body for every day during a given period. When the elements of a planet's or comet's orbit are known an ephemeris can be calculated for its future position. Accurate ephemerides for the sun, moon, and planets are published in advance in the Nautical Almanac.

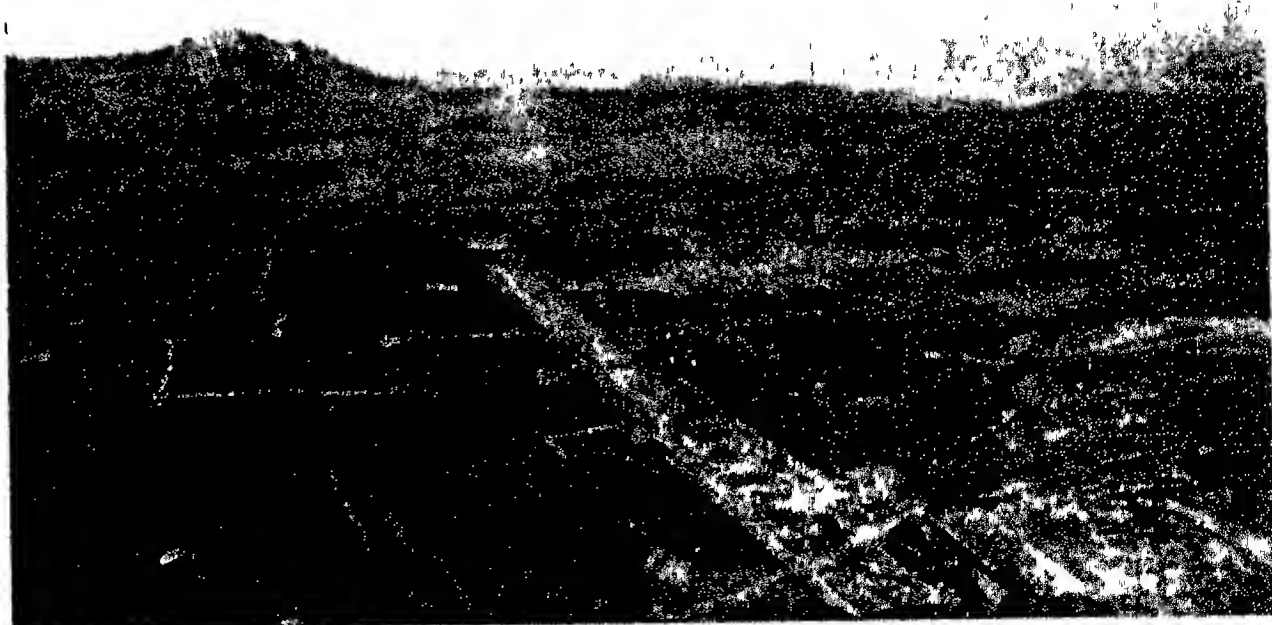
Ephesians, EPISTLE TO THE. The first of the group of Pauline epistles commonly known as the Epistles of the Captivity, because they seem to have been written probably between A.D. 61 and 63, during S. Paul's first imprisonment in Rome. It was probably intended to be a circular letter, and was not addressed particularly to the Ephesians. It contains no personal greetings to the friends of the apostle, and in the two best Greek MSS the words "in Ephesus" ("to the saints which are in Ephesus") are omitted. Moreover, Marcion speaks of it as the Epistle to the Laodiceans.

Its connexion with the Epistle to the Colossians is so close that the one is sometimes supposed to be an expansion of the other, but such a supposition is unnecessary. The external evidence for the authenticity of the epistle is sufficient, if not conclusive. As regards internal evidence, the fact that the language and thought differ somewhat from those of other Pauline epistles has caused difficulties, but these are by no means insuperable. The circumstances that impel a writer to take

up the pen, the mood in which he writes, are not always the same, and, in the interval between the writing of one epistle and another, the language and thought of S. Paul may have undergone considerable development as a result of his experiences.

Ephesus. Ancient city of Asia Minor, situated on the river Cayster, not far from its mouth. It was the chief of the twelve Ionian colonies of Asia, and was founded probably about 1000 B.C. In the 6th century it fell, with the other Greek cities of Asia Minor, under the dominion of Croesus, king of Lydia, and later under that of Cyrus the Great, king of Persia. During the Athenian hegemony it paid tribute to Athens, but about the beginning of the 4th century B.C. it again passed under Persian rule. When Persia was overthrown by Alexander the Great, it acknowledged the Macedonian supremacy, then that of the Seleucidae, and eventually became the administrative capital of the Roman province of Asia. Its decline was due in the main to the silting up of its harbours.

Ephesus was noted for the worship of Artemis or Diana; its temple to the goddess was regarded as one of the seven wonders of the ancient world. The city was visited by S. Paul on his second and third journeys, and was an early seat of Christianity. Ephesus was the birthplace of the philosopher Heraclitus. There are ruins of a theatre (Acts 19, 27), a stadium or racecourse, an odeum or hall in which musical and poetical contests took place, and the temple of Artemis. Consult Discoveries at Ephesus, J. T. Wood, 1877; Excavations at Ephesus, D. G. Hogarth, 1908.



Ephesus. Excavated ruins, looking towards the sea: in the foreground, ancient main street; in the distance, the prison of S. Paul, on the hill top

Ephesus, COUNCILS OF. Six important councils of the Church held between the 2nd and 5th centuries. The first took place A.D. 197, on the question of the date of the observance of Easter; and the second in 245, against the heresy of Noëtus.

The third council, 431, was the third oecumenical council of the Church, and dealt especially with the Nestorian controversy on the person of Christ (*see* Nestorians). Cyril, archbishop of Alexandria, had denounced Nestorius, and the emperors Theodosius and Valentinian convoked a general council to decide the matter. The council confirmed the Nicene Creed, condemned the heresy of Nestorius, and also settled certain points of discipline. The fourth council, 440, and the fifth, 447, met to decide a question of episcopal succession. The sixth or robber council, convened by Theodosius in 449, dealt with disputes about individual bishops and clergy, but its general findings were tainted by outside influences and were superseded by the council of Chalcedon in 451.

Ephialtes (d. 456 B.C.). Athenian statesman and democratic leader, who opposed Cimon (*q.v.*), the leader of the aristocratic party, and was associated with Pericles. Among the reforms of Ephialtes was the limitation of the power of the Areopagus. He is not to be confused with the traitor of the same name who, when Leonidas and his Spartans were defending the pass of Thermopylae in 480 B.C. against the Persians, showed the enemy a path whereby the defenders of the pass could be taken in the rear. In Greek mythology, Otus and Ephialtes were giants, who rebelled against the gods, and endeavoured to pile Ossa on Olympus and Pelion on Ossa. *Pron.* Eff-alteez.

Ephod. Symbolical waistcloth worn by the Jewish priests when officiating. That worn by the high priest was of fine linen, coloured gold, blue, purple, and scarlet, worn over a blue robe, fastened round the body by a girdle, and supported by two shoulder-straps, each ornamented with an onyx stone inscribed with the names of six of the 12 tribes. Attached to the front of it was



Ephod. Jewish high priest wearing the ephod, shown knotted below the breastplate

the breastplate (*q.v.*). References are made in Exodus 28, 29, 39; Lev. 8; Judges 17; 1 Sam. 2 and 22; 2 Sam. 6.

Ephor (Gr. *ephoros*, overseer). Spartan official. Originally appointed by the kings to take over certain police and judicial duties, the ephors gradually became the most influential body in the state. After the second Messenian War (685-668 B.C.), they became an independent magistracy. Five in number, and elected by the Apella (the Spartan general assembly), they held office for a year. They possessed civil jurisdiction, looked after public morals, had the right of dismissing, fining, and imprisoning public servants, and even the kings were subject to their authority. Two of them accompanied the king in the field to keep a watch on his movements. They summoned and presided at the public assemblies, controlled the finances, and conducted negotiations with the representatives of foreign powers. When Agis IV tried to limit their authority, he was imprisoned by their order, and murdered (240). The ephorate was abolished by Cleomenes III, but restored after he lost the throne in 221, although it never recovered its former position. *See* Sparta.

Ephraem Syrus OR EPHRAIM THE SYRIAN (c. 306-378) Theologian and sacred poet. A native of Nisibis, where he spent his youth in study, about the year 363 he removed to Edessa, where he lived the life of a hermit, and was ordained deacon. He devoted his life to teaching and writing, and assisted the poor during a great famine.

Ephraim. Second son of Joseph. With his brother, Manasseh, he was adopted by their grandfather Jacob, and their descendants were reckoned among the tribes of Israel. Ephraim took precedence of his elder brother Manasseh, but nothing is known of his personal career. The tribe of Ephraim occupied part of the northern territory of Palestine. Joshua belonged to this tribe.

Ephrath OR EPHRATHAH (fruitful). Old name for Bethlehem (*q.v.*), in Palestine.

Épi. This is a French architectural term denoting a small finial (*q.v.*).

Epiblast (Gr. *epi*, on; *blastos*, shoot). Term used in embryology for the outer covering of the organism when it has reached the stage of a three-walled sac or gastrula. *See* Ectoderm.

Epic (Gr. *epos*, tale, song). Name given to narrative poetry which deals in dignified and elevated style with some important action,

usually heroic. The great examples are the Iliad and Odyssey of Homer, which are unmatched in any other language. Other peoples and later ages, however, produced poetry descriptive of great events to which the term epic has been generally and legitimately applied, such as the French Song of Roland and the English Beowulf. These all belong to the authentic, as distinguished from the literary, type, that is, they are "poems of growth," not the work of a single age or author, but stitched together by generations of bards from the myths and traditions of their race, embodied in older and more primitive lays and ballads. Such poems are important as historical documents. Though mingling fiction with fact, they preserve irreplaceable accounts of the manners and customs, and the political, social, and religious ideas of times otherwise unchronicled.

English Epics

Beowulf, for example, raises the curtain which hides the early life of our forefathers, and in its persons, scenes and episodes reveals many of the mental and moral characteristics of the race, as well as elements of the social order which still prevails in the British islands. Several other narratives which fall short, indeed, of the unity and completeness of the more famous heroic poems, still display many of their essential features, like the English Maldon, a splendid though comparatively late piece of the 11th or 12th century. Rhymed chronicles like Layamon's Brut partake of the epic character in that they contain fragments of actual history and are heroic in scope and intention, but deficient in plan and insufficiently elevated in style to bear comparison with the Iliad or Paradise Lost. Paradise Lost belongs, like Virgil's Aeneid or Tasso's Gerusalemme Liberata, to the artificial, invented or literary type. These are imitative poems, written in the epic manner by learned authors in epochs of advanced civilization. They are the works of bookmen, who describe events of which they had no personal knowledge and their value and interest rest wholly upon the imagination and poetical skill at work in their construction.

Few such attempts were greatly successful; nevertheless, since they followed the tradition and endeavoured to treat a noble subject worthily, they are properly to be styled epic. The Renaissance, on the other hand, produced many chivalric and romantic narratives, of epic dimensions certainly, like those of Ariosto and Spenser. Some are humorous, some serious, but

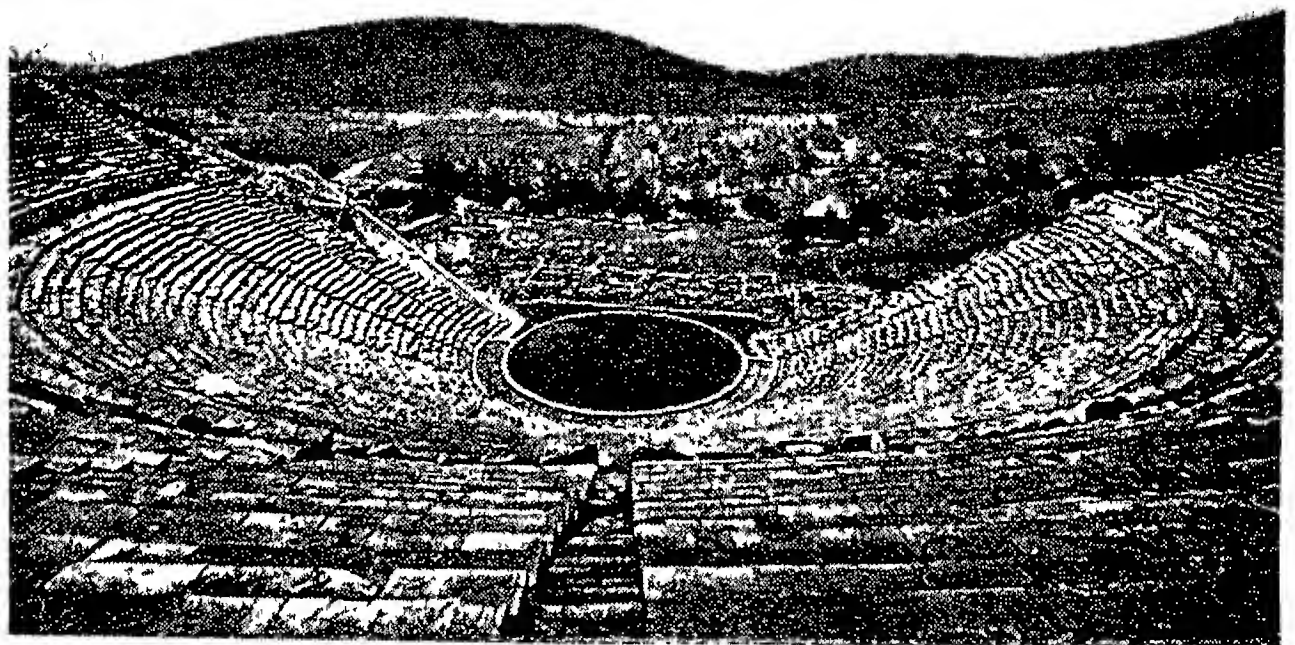
even when serious, and however charged with poetic quality—since they forsook the region of the heroic, of events that might have happened, for the region of the symbolic, marvellous, or incredible—have little in common with the true and original types. In the mock-heroic, like the classical *Batrachomyomachia*, or *Battle of the Frogs and Mice*, or Pope's *Rape of the Lock*, the manner and machinery of epic poetry are imitated, the great style applied to the trifling subject, with humorous intention or for the purposes of parody or burlesque. In modern times probably the nearest approach to the epic spirit is realized in *The Dynasts* of Thomas Hardy. See Poetry.

Epicharmus (c. 540–450 B.C.). Greek comic poet. Born in Cos, he went early to Megara in Sicily, but after its destruction in 483, he removed to Syracuse, where he enjoyed the patronage of the "tyrants" Gelo and Hiero. The chief representative of the Dorian or Sicilian comedy, his 35 plays written in the Doric dialect, of which only scanty fragments remain, dealt chiefly with mythological subjects (*Busiris*, the shipwrecked *Odysseus*, the *Sirens*). They were distinguished by rapidity of action, in which, according to Horace, they served as a model for Plautus.

Epictetus. Stoic philosopher who lived about 100 A.D. Born at Hierapolis in Phrygia, he was taken as a slave to Rome. Having been given his freedom, he became an adherent and teacher of Stoicism, and when Domitian expelled the philosophers from Rome, Epictetus removed to Nicopolis, in Epirus, where he lived until the reign of Hadrian. One of his pupils, Arrian the historian, published his *Discourses* and a *Manual* of his doctrines. The latter and four books of the *Discourses* are extant. According to Epictetus, we are only concerned with things that are under our control; all other things are *adiaphora* (indifferent). The good is that which corresponds to reason and the general moral ideas implanted in us; the bad is that which runs counter to them. The highest principles of life are patience, abstemiousness, and self-control. Epictetus assumed the existence of *daimonia*, spirits which, like that of Socrates, accompanied man everywhere and acted as his guardians through life.

Epicureanism. The doctrines of the school founded by the Greek philosopher Epicurus (341–270 B.C.). He was of Athenian parent-

age, and born in Samos. Coming to Athens, he founded his school in his Garden, which became as famous as the Stoic Porch about 306. Epicurus divided philosophy into three parts: Canonics (logic, the theory of knowledge), Physics, and Ethics. The basis of all knowledge is the evidence of sensual perception; all perceptions are true and irrefutable. Opinions are true or false,



Epidaurus, Greece. Although this theatre dates from the 4th century B.C., nearly the whole of the stone seating is still in position; the foundations of the stage buildings are seen beyond the circular orchestra

according as they are confirmed or refuted by perception.

In physics Epicurus agrees in the main with Democritus, the founder of the atomic theory. Bodies are formed by the collision and combination of an infinite number of atoms in infinite space. The number of worlds also is infinite. The gods, made of the finest atoms, do not trouble about the world or human affairs, but live happily in the empty spaces between the different worlds. The soul is material, made up of the finest atoms dispersed throughout the body. There is no such thing as immortality; after death the soul-atoms are scattered. Sensation is due to effluxes and images, which issue from the surface of things and pass through the air to the sight or understanding.

In ethics Epicurus follows the Cyrenaics. Pleasure is the aim of life, the only happiness. No pleasure is bad in itself, but only pleasure in rest—freedom from pain—is a true good. The virtuous man, he who rightly pursues pleasure, is alone happy.

Epicureanism is used today of addiction to sensual enjoyment, more particularly that of the table. See Ethics; Philosophy.

Epicycle (Gr. *epi*, upon; *kyklos*, circle). A circle, the centre of which moves along the circumference of a

greater circle. In Ptolemy's system of the heavens each of the "seven planets" was supposed to revolve in an epicycle. This obsolete explanation describes with approximate truth the relative motion of a planet with regard to the earth, if the earth is assumed to be stationary.

Epidaurus. Town of Argolis, ancient Greece, situated on the Saronic Gulf. It was famous for its

temple of Asclepius (Aesculapius), the god of healing, about 8 m. distant, which was extensively visited by the sick from all parts of Greece. Miraculous cures similar to those at Lourdes are recorded. Excavations carried on since 1881 have revealed remains of the temples of Asclepius and Artemis, of a tholos or rotunda, and inscriptions connected with the worship of Asclepius. Outside the sacred precincts is the loveliest and best preserved of the theatres of classic Greece. It was designed by the younger Polyclitus (4th cent. B.C.). The original fully circular orchestra is still visible. The auditorium seated at least 16,000 people, and the acoustics were so good that a performer speaking in ordinary tones could be heard from every seat in the auditorium.

Epidemic (Gr. *epi*, in; *dēmos*, people). Occurrence of a disease among a number of persons about the same time. When a disease is continually present in a locality the term endemic is applied to it. A pandemic is an outbreak of a disease which extends over the whole or a large part of the world. In the Middle Ages, when sanitation was non-existent, epidemics were of frequent occurrence and were usually regarded as manifestations of divine wrath. Later the communicability of the disease from one

person to another was recognized, and the cause of the outbreak was looked for in climatic occurrences or cosmic phenomena—for example, the influence of a comet.

In the 18th and 19th centuries more scientific views were gradually established, and it was recognized that the disease was conveyed from one to another by some morbid or poisonous agent, which was eventually found in most cases to be a bacillus or other micro-organism. Epidemics are spread by various agencies. Pollution of drinking water by sewage has been the commonest cause of outbreaks of cholera and typhoid fever. Epidemics of diphtheria have frequently been spread by contaminated milk. In other cases insects or animals have been the transmitting agent. Typhus fever, for example, is conveyed by the bite of the louse, and plague by the rat flea. Airborne infection has been confirmed as the method of transmission of influenza, of scarlet fever, and of smallpox. Epidemics may also be caused by wholesale contamination of food with poisonous substances. In 1900 there was an epidemic of arsenical poisoning in the N. of England due to the contamination of beer with arsenic derived originally from arsenical iron pyrites from which sulphuric acid used in the manufacture of the beer had been made. Epidemics of lead poisoning have also followed the contamination of drinking water by lead derived from cisterns and conduit pipes.

The prevention and arrest of epidemics necessitate active measures which vary with the particular circumstances controlling the disease. Some system of notification of affected persons, followed by their isolation, is important. This is possible only in advanced communities and where the severity of the disease justifies the course and the numbers are not too great to cope with. It could be followed in Great Britain during outbreaks of smallpox, but would be a difficult matter with influenza. Public health is now an important department of medicine, dealing with preventive measures against widespread outbreak of disease, and limiting such an outbreak should it occur. See Plague; Public Health.

Epidendrum (Gr. *epi*, on; *dendron*, tree). Large genus, mainly

of epiphytes, of the family Orchidaceae. They are natives chiefly of S. and Central America and the W. Indies. They have leathery, strap-shaped leaves, and



Epidendrum. Typical flower bud and leaves

flowers solitary or disposed in spikes or sprays. The characteristic features of the genus are the union (more or less complete in different species) of the fleshy base of the lip to the column, a passage at the base of the lip, and the four compressed pollen-masses. Some of them have handsome flowers,

but in many species these are of a dingy green hue.

Epidermis (Gr. *epi*, on; *derma*, skin). Name for the superficial layer of the skin, lying above the *cutis vera* or true skin. It is formed by a number of layers of cells, the most superficial of which consist of stratified epithelium, and are horny in character. These form the thickest part of the epidermis. Beneath the horny layers are several layers of clear rounded cells forming the *stratum lucidum*; next is a layer of granular cells, the *stratum granulosum*. In these strata the change from protoplasm to horny material takes place. The deepest layers constitute the *rete mucosum* or Malpighian layer, and consist of soft protoplasmic cells. The epidermis grows from the deeper layers, the superficial horny cells being continually shed. It has no blood vessels, but fine nerves ramify in the deeper layers. The term is used also for the cuticularised superficial cell layer in plants. See Skin.

Epidiascope (Gr. *epi*, on; *dia*, through; *skopein*, to look). Apparatus of the optical lantern type. Originally intended for projecting on to a screen images of opaque bodies such as insects, coins, diagrams, etc., in their natural colours, it can also be used for projecting transparent objects; e.g. lantern slides and microscopic preparations can be shown with considerable magnification. The illumination is provided by lamps located at the focus of parabolic mirrors; the light is thrown upon, or transmitted through, the object by a system of condensers and mirrors. An epidiascope enlarger is used in the dark room for making photographic prints from negatives on opaque substances.

Epididymis (Gr. *epi*, on; *didymos*, testicle). In anatomy, a convoluted tube which receives the

ducts from the testis, and is prolonged into a tube, the *vas deferens*, through which the seminal fluid passes to the urethra.

Epidiorite. Crystalline rock derived by metamorphism from basalt or dolerite. By alteration original augite is converted to hornblende, and the rock assumes the general mineral assemblage of a diorite (*q.v.*). Epidote, chlorite, sphene, and quartz are usually present as secondary minerals. It is common in the Scottish Highlands and other areas composed of ancient metamorphosed rocks.

Epidote. Basic silicate of calcium and aluminium. It is found abundantly, but outside Austria and America is rarely of sufficient transparency and fine colour to be cut as a precious stone. The colour ranges from green to brown. Its specific gravity is from 3.25 to 3.5. Piedmontite is a manganese epidote originally found in Piedmont, some valued specimens being characterised by a magnificent cherry-red colour. Epidote is formed by metamorphism of lime-rich rocks.

Epiglottis (Gr. *epi*, on; *glossa*, *glotta*, tongue). Thin leaf-shaped structure, consisting of fibro-cartilage, placed behind the root of the tongue and in front of the superior opening of the larynx. It was



formerly supposed that it was bent back during the act of swallowing and served as a lid to close the larynx; but it is now recognized that the closing of the glottis is effected by the arytenoid and thyro-arytenoid muscles.



Epiglottis seen from the front. Upper picture sectional diagram showing position of this structure in the throat

Epigoni (Gr., descendants).

In Greek legend, the sons of the seven heroes who fell in the war against Thebes. See Adrastus.

Epigram (Gr. *epi*, upon; *gramma*, a writing). Originally a simple inscription attached to religious offerings. It was afterwards written on the temple gate, and by easy tradition passed to other public edifices and to statues of gods, heroes, and all who had dis-

tinguished themselves by patriotism, courage, and virtue. The term at first included inscriptions in verse or prose, and the form was employed by legislators and philosophers to convey any political or moral precept, its brevity impressing it readily upon the memory. Finally, among the Greeks, the epigram came to signify any short piece of poetry which conveyed a single idea with neatness and grace. The Greek Anthology contains epigrams characterised by delicacy and truth of sentiment, and by elegance of expression, and entirely devoid of satire, play upon words, and even of conceit. Even in the lighter convivial epigrams the thought is generally of a melancholy cast, and the sepulchral inscriptions show simple delicacy and perfect appropriateness.

In the hands of the Latin epigrammatists the epigram acquired a new character. The term was now applied to any brief and concise composition in prose or verse, in which a single idea was expressed and the point made by antithesis, surprise, or play upon words. Catullus and Martial are the acknowledged masters of the Latin verse epigram, Tacitus of its prose equivalent. Despite much conceit and some obscenity Catullus excelled all other Roman wits in elegance and beauty, while Martial stands supreme in wit and fecundity, in brevity, smartness, and variety. As used by Martial, and in the modern sense, the verse epigram has been defined as a short poem, generally of a personal character, meant to vex somebody, to pay off an old score, or to be smart at someone else's expense. In the best examples the point is made unexpectedly in the last word, wherefore the epigram has been compared to the scorpion because "as the sting of the scorpion lyeth in the tail, so the force and virtue of the epigram is in the conclusion."

Modern Writers of Epigrams

Of modern literatures the Italian contains the nearest approximations to the Greek epigram in respect of feeling, though not of simplicity, in the softly melodious, elegant, and pathetic songs of Metastasio and the amatory verse of Guarini, Tasso, and others. Pananti, in the early 19th century, wrote epigrams notable for their causticity, political allusion, and boldness. The French madrigal is sometimes written in the spirit of ancient Greece, and is often unequalled in condensation of thought, happiness of epithet, and

delicacy of turn. Voltaire, however, is the supreme French epigrammatist, writing on every conceivable subject and with every degree of merit.

English literature is deficient in the serious and tender style of epigram, but singularly rich in the witty and satirical. The 18th century was the flowering time of the English verse epigram, which was admirably suited to the malicious wit of Pope, the whole of whose poetry, indeed, is a string of epigrams. As epigrammatist, he stands head and shoulders above all other English poets. Owing to their vagueness and inappropriateness, his epitaphs are notoriously bad, but his epigrams are of the highest polish and point. His epigram on epitaphs, addressed to Dr. Robert Freind, headmaster of Westminster School, runs thus:

Freind, for your epitaphs I'm grieved;
Where still so much is said,
One half will never be believed,
The other never read.

Epigraphy (Gr. *epi*, on; *graphein*, to write). Study of inscriptions. In practice it concentrates upon inscriptions on durable materials such as stone, metal, and wood, including coins, gems, ornaments, seals, vases, and weapons, whereas palaeography studies the forms of writing upon papyrus, parchment, and paper. When concerned with form it is a branch of palaeography, but in addition it deals with subject-matter. Important departments are Chinese, Greek, Hittite, Latin, Indian, Runic, and Semitic epigraphy. See Inscriptions; Palaeography.

Epilepsy or FALLING SICKNESS (Gr. *epilēpsis*, seizure). Disease of the nervous system characterised by periods of unconsciousness. Two forms are recognized: *petit mal*, or minor epilepsy, in which convulsions do not occur; and *grand mal*, or major epilepsy, marked by the occurrence of convulsions or fits. Epilepsy may begin before the fifth year; first indication of the disease after thirty is less common. The fundamental cause is unknown, though fright, injury, and an attack of illness sometimes appear to be exciting causes. Hereditary influences play a part, the offspring of those who suffer from insanity or neurasthenia being rather more prone to exhibit epilepsy than other children. In *petit mal* the attacks of unconsciousness often last no longer than a few seconds. The individual may suddenly stop talking and his eyes stare fixedly; after a few moments he resumes his talk as if nothing had happened

Grand mal is characterised by the occurrence of convulsive fits. In many cases the subject has a preliminary sensation or *aura*, which warns him of what is going to happen. This may take the form of tingling or sensation of heat or cold in the limbs or face, flashes of light before the eyes, noises or voices in the ears, or uneasy sensations in the stomach. After an interval of varying duration the patient suddenly loses consciousness, and may fall to the ground without making any effort to save himself. Sometimes the beginning of the fit is marked by a loud cry. At first the muscles are rigid; the jaws are clenched, the limbs extended, and suspension of respiration causes blueness of the face. After a few seconds, violent convulsions occur; the limbs are jerked about, the muscles of the face twitch, and the tongue may be severely bitten. After one or two minutes the patient passes into a state of coma which may be succeeded by prolonged sleep. In severe cases fits may rapidly follow each other, and consciousness may not be regained in the intervals.

Variant Forms of the Disease

Masked epilepsy is a form in which the fits are replaced by attacks of delirium or outbursts of maniacal fury, during which the sufferer may commit crimes of brutal violence or destroy himself. In another form there is loss of memory. A person may leave his home and wander about the country, behaving like a normal being, but having forgotten his previous life or even his name. After an interval his old self returns and he has no knowledge of what has happened in the interval.

Jacksonian epilepsy is a condition in which consciousness is not lost, and the spasms affect only part of the body. The condition is probably quite distinct from true epilepsy; it is the result of some irritation of the brain, and may be due to injury.

In epilepsy, characteristic electrical discharges occur in the brain. These can be recorded on the electro-encephalogram, an instrument used in diagnosis.

During an actual fit all that can be done is to prevent the patient from hurting himself. He should be allowed to remain in the recumbent posture, the clothes should be loosened round the neck, and a roll of cloth should be introduced between the teeth to prevent the tongue from being bitten.

The most useful drugs in the treatment of epilepsy are the bromides of sodium and potassium and the phenobarbitone family. These should be given for possibly two years, the amount and frequency of the dose depending upon the severity of the condition, the age of the patient, and the manner in which he reacts to treatment. Enough should be given to ward off recurrent attacks, which weaken mental power.



Épinal, France. The town, looking up the Moselle towards the wooded Vosges Mountains

An epileptic should lead a quiet life. He should not take alcohol; and his meals should be light and moderate. It is better for the patient to be at work or occupied, provided the occupation is not one which subjects him to danger if a fit occurs. When epilepsy develops, a thorough examination should be made in order to eliminate any possible sources of reflex irritation such as adenoids, worms in the intestine, etc.

Epilogue (Gr. *epilogos*, conclusion, peroration). Short address in prose or verse frequently employed to round off a dramatic performance; sometimes in the form of an appeal to public favour for the play it followed, sometimes explanatory or even apologetic. Many of the plays of Shakespeare and other great dramatists were provided with epilogues. In the 17th and 18th centuries the epilogue was frequently written by a friend or patron of the playwright. The use of the epilogue, as of the prologue, went out of fashion before the close of the 19th century, except on special occasions. The term was adopted by the B.B.C. for a short Sunday evening service of texts and singing, first broadcast in 1926.

Epimenides. Greek legendary priest and miracle-worker. A native of Crete and associated with the worship of the Cretan Zeus and Apollo, he was summoned to

Athens in 596 B.C. to purify the city from the curse of Cylon (see Alcmaeonidae). He was the author of oracular and purificatory poems, and is supposed to be the "prophet" of S. Paul's epistle to Titus (1, v. 12), according to whom the Cretans were "always liars." Some regard him as an entirely mythical character. *Pron.* Ep-pi-menni-deez.

Épinal. Town of France. The capital of the dept. of Vosges, it is situated on both sides of the Moselle, 190 m. E.S.E. of Paris. It makes embroidery, hats, images, and has long been noted for the production of pictures for children. It has extensive quays and promenades. With Belfort, Verdun, and Toul it formed, during the First Great War, the first line of French permanent defences along the lines of

the Moselle and the Meuse. The fortress of Épinal was built after the Franco-Prussian War, and was one of France's most important works of defence. There is a monument to the French who fell in the war of 1870-71. A 12th century tower is preserved as part of the church of S. Maurice. The town has been French since 1766. Pop. 23,395.

Épinay, LOUISE FLORENCE PÉTRONILLE D'ESCLAVELLES D' (1726-83). French author. Born at



Louise d'Épinay.
French author
After Liotard

Valenciennes, March 11, 1726, she married in 1745 her cousin Denis de la Live de Bellegarde, who soon afterwards deserted her. Her charm and literary ability made her many friends among writers of her day, J. J. Rousseau, Voltaire, Diderot, and Grimm among others. For Rousseau she built in 1756 the Hermitage, in the valley of Montmorency; the story of their intimacy is told in his Confessions, but after little more than a year they quarrelled. She died April 17, 1783.

Her chief writings were her *Mémoires*, published in 1818, a lively picture of her literary circle

and Parisian society, the names being fictitious, and her *Conversations d'Émilie*, 1774, crowned by the French Academy, 1783.

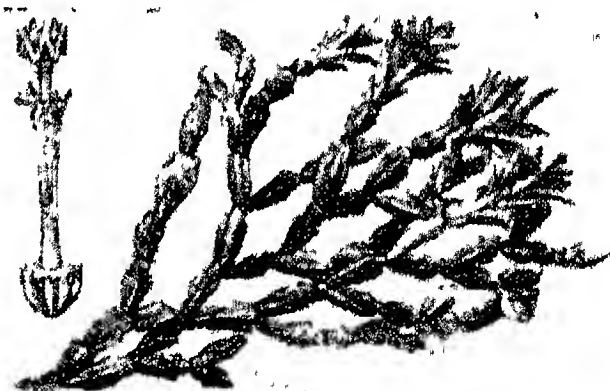
Epiphany (Gr. *epiphainein*, to manifest). Festival of the Christian Church, celebrated on Jan. 6. The English Prayer Book title is The Epiphany, or The Manifestation of Christ to the Gentiles. Formerly the Epiphany seems to have been part of the festival of Christmas, which lasted twelve days. It commemorated the manifestation of Christ's birth to the Magi (which in medieval times was associated with a mass of picturesque legends), the manifestation of the Trinity at Christ's baptism, and Christ's first miracle at Cana.

In the Greek Church the festival is a special day for baptism.

In England on this day it was customary for the sovereign to offer gold, frankincense, and myrrh at the altar. Since the time of George III this offering has been made at the Chapel Royal, St. James's, by an officer of the royal household. *See* Calendar; Twelfth Day.

Epiphora (Gr., bringing upon, sudden attack). Persistent overflow of tears down the cheek, usually due to obstruction of the lachrymal duct. *See* Lachrymal Gland and Duct.

Epiphyllum (Gr. *epi*, on; *phylon*, leaf). Small genus of climbing sub-shrubs, members of the family



Epiphyllum. Fleshy branches and flowers of *Epiphyllum truncatum*, a Brazilian cactus

Cactaceae. They are natives of Brazil. They have thin cylindrical stems, 2 ft. or 3 ft. high, with short, fleshy, leaf-like branches, whose broad ends produce large, showy flowers of pink or crimson hue.

Epiphysis (Gr., on-growth). Part of a bone which develops from a separate centre of ossification and is at first attached to the main part of the bone by cartilage, which ultimately is replaced by bone. In the humerus, or upper arm bone, for instance, the upper end forms an epiphysis which is not united to the shaft by bony union until about the 20th year, and the lower end is another epiphysis which unites about the 16th year.

Epiphytes (Gr. *epi*, on; *phyton*, plant). Plants which, instead of being rooted in the soil, grow upon the surface of other plants, chiefly trees. Large numbers of the tropical orchids are of this character, and are therefore known as epiphytic orchids. Some ferns and mosses have the same habit. True epiphytes do not derive any of their nutriment from their hosts, and are often called air-plants.

Epirus (Gr. *ēpeiros*, mainland). Country in the N.W. of ancient Greece. It was bounded by Illyria, Macedonia, and Thessaly on the N. and E., and by the Ionian Sea on the W. The original inhabitants were so-called Pelasgians, like those in other parts of Greece, but the Epirotes of historical times were a mixed race. The most famous king of later times was Pyrrhus (d. 272 B.C.), who seriously challenged the power of Rome. In Epirus was the celebrated oracle of Zeus at Dodona.

The modern district of Epirus extends from N.W. Greece into

S. Albania. This disputed area of some 3,700 sq. m. has an est. pop. of 350,000. In Epirus during the Second Great War the Greeks defeated Italian forces in Oct.–Nov., 1940, and resisted the Germans from the invasion in April, 1941, until the territory was liberated in Nov., 1944.



Episcia. Foliage and bloom of this Central American plant

Episcia. Genus of perennial herbs, members of the family Gesneriaceae. Natives of Central America and the West Indies, they have opposite leaves and beautiful funnel-shaped flowers. In colour they are white, flesh-tinted, lilac, vermilion, or crimson.

EPISCOPACY: CHURCH RULE BY BISHOPS

Rt. Rev. A. E. John Rawlinson, D.D., Lord Bishop of Derby

The origin in earliest Christian times and the subsequent development of the system of church government by bishops, found, with certain differences, in the Anglican, Eastern, and Roman Catholic communions, are here described. See Anglicanism; Church of England; Diocese; Roman Catholic Church, etc.

The word episcopacy, meaning the system whereby spiritual authority and pastoral oversight in the Christian church is entrusted primarily to bishops, is derived from the Greek *episkopos*, one who exercises oversight. A distinction corresponding to the later distinction between clergy and laity existed in Christianity from the beginning, the original "ministry" of the church consisting of the apostles chosen by Christ. Other orders of ministers quickly began to emerge—in the N.T. there is reference to the appointment of "presbyters" (Acts 14) and to the existence of "bishops and deacons" (Phil. 1), though their respective functions cannot be precisely determined, and, originally, the chief pastoral oversight of the developing church was in the hands of the "Twelve" (the place of the traitor Judas having been filled, according to the narrative of Acts 1, by the appointment of Matthias), though an authority equal with theirs was conceded to S. Paul as the apostle to the Gentiles (Gal. 2; 1 Cor. 9) and apparently also to Barnabas, and a position of special importance was occupied also by James, the Lord's

brother (Acts 15, Gal. 1). The pastoral epistles (1 and 2 Timothy, and Titus) imply the exercise of authority over groups of local churches by their respective recipients, apparently as delegates left in charge by S. Paul. In 1 Timothy and in Titus, there are passages referring both to "bishops" (1 Tim. 3; Tit. 1) and to "presbyters" (1 Tim. 5; Tit. 1). It has been thought that in Tit. 1 "presbyter" and "bishop" may be two names for the same office; and, on the other hand, in 1 Tim. 5 the context suggests that the term "presbyter" (which means literally "an older man") is used in its etymological significance rather than as the designation of an office in the church (cf. Tit. 2, where, however, a variant term is used in the Greek original).

The view has been widely held that originally "presbyters" and "bishops" were the same (cf. Acts 20, v. 17 with 20, v. 28), or at least that, when the two were distinguished, the term "bishop" denoted simply a presbyter entrusted with special functions of "oversight" which his fellow-presbyters did not in all cases share. To this day, in R.C. theo-

logy (contrast the Eastern Orthodox and Anglican view, according to which the three "orders" of the ministry are those of bishops, priests, and deacons), bishops and presbyters, notwithstanding the fact that bishops are specifically "consecrated" as such and hold authority over the presbyters, are reckoned as together constituting the single "order" of priesthood, the other two sacred "orders" of the ministry, according to the R.C. reckoning, being those of deacon and sub-deacon.

Whatever may have been the precise functions of "bishops" in the earliest period of all, and whether or not they were differentiated in any specific fashion from "presbyters," they appear in the N.T. as ministers of local "churches," holding office in subordination to the general oversight of the apostle or other "missionary" by whom their "church" had been founded. The second Christian generation inevitably found the local "churches" deprived of such supervision by "apostles" or "missionaries." The local "bishops" succeeded no less inevitably to many of the functions of the original "apostles." They were the local rulers of the church, administered its discipline (probably with the help of the presbyters), were its principal teachers, and were the normal ministers of its sacraments and leaders of its worship.

Church Rule in the 2nd Century

The system reflected in the epistles of S. Ignatius (an early 2nd century martyr-bishop from Antioch in Asia Minor) quickly became universal. At the head of each local church there was a bishop, who in the general control of the church was assisted by presbyters. At the church's assembly for worship the bishop presided at the Eucharist, flanked by presbyters upon either side, and assisted by deacons. "Nothing apart from the bishop" is the slogan of these epistles: if the bishop himself was not able to preside at the Eucharist, the celebrant must be someone deputed by him—presumably one of the presbyters. At the stage represented by the Ignatian letters, the local church in each city was probably still small enough numerically to be assembled together for worship in one "congregation." As numbers grew, and the bishop's "diocese" (a word which means literally "sphere of administration") expanded, the formation of branch congregations would be inevitable; presbyters were put

in charge of them, with the result that many of the bishop's liturgical and other functions came to be habitually and normally shared by presbyters, who developed into what (to use a later term) might be called "parish priests," exercising a subordinate "cure of souls" under the bishop.

In the developed system of later centuries, the only liturgical functions exclusively reserved to the bishops were those of taking part in the consecration of fellow-bishops, ordaining men to the ministry (in the case of an ordination to the presbyterate or "priesthood," with the assistance of presbyters), and (in the Western part of the church) confirming or "sealing" the baptized. Yet the bishop of each diocese remained still the chief pastor of the church under his jurisdiction. His diocese might come to include numerous "parishes," he might have large numbers of clergy working under him, he might have an assistant bishop or bishops (commonly called "suffragan" bishops) to help him; but he remained still the one bishop of the diocese, the representative of his church in relation to neighbouring churches, and within his own area supreme.

The Unit of Church Government

In the countries surrounding the Mediterranean sea the normal area of a bishop's diocese has throughout the centuries continued to be quite small, each of the leading cities (and many quite small ones) becoming eventually the seat of a bishopric. In northern and western Europe, and (with the spread of Christian missions) in many other parts of the world, dioceses were as a rule (and still are) very much larger. Large or small, however, wherever episcopacy obtains, the diocese, under its bishop, remains the primary unit of the ordered life of the church. The grouping of dioceses into provinces, each under an archbishop, or (in the Eastern Church) into patriarchates, each under a patriarch, does not radically affect the truth of this generalisation, the powers of an archbishop or of a patriarch in relation to dioceses other than his own being of a strictly limited kind. Only in the R.C. Church (more especially since the adoption in 1870 of the constitution *Pastor Aeternus*) is the claim made that a particular bishop exercises, as the successor of S. Peter, a direct and immediate jurisdiction over all other bishops, and, indeed (according to the R.C. view), over all Christians everywhere.

In the 16th century the bishops in most countries affected by the movement of reform in the church refused their support to the Reformation, with the result that a breach with Rome was found to involve also a breach with the episcopate. Both in England and in Sweden an episcopate with continuous succession was maintained, but the succession elsewhere was broken. The (Lutheran) churches of Norway and Denmark have retained titular bishops, though with a broken continuity and without specific consecration to episcopal office; and the title and office of "bishop" (here also without continuity of succession) have been revived in some protestant areas of modern Germany, and by "Methodist Episcopalians" in the U.S.A.

Free Churches Reject Episcopacy

The majority of Protestant churches at the time of the Reformation adopted forms of church government in which no provision was made for episcopacy. In England the Puritan party in the church disliked and attacked the episcopal system and eventually seceded from the church. Their spiritual successors—the English "Free Churches"—have no bishops in their churches, and are traditionally hostile to episcopacy. Yet it is noteworthy that in quite recent times many of their leaders have come to recognize that, in any future scheme for church reunion, the acceptance of the episcopate as "the means whereby the authority of the whole church is given" to the ministers of the church at their ordination would be inevitable, and that "it ought to be accepted as such." So, too, in the constitution of the United Church of S. India it is laid down that the future church shall be organized in dioceses under the pastoral oversight of bishops.

In the Church of England, while there is an acceptance of episcopacy in practice, there are divergent views held as to its necessity. One school of thought maintains that in strictness the ordination of the clergy by bishops duly consecrated through a succession of ordinations and consecrations continuous with the church's past, and going back to the original days of the apostles, is essential for a "valid" and duly authorised ministry; another school, while regarding episcopacy as (upon the whole) the most desirable form of church government, would refuse to go further than this, or to regard as "invalid" (even in a technical sense) the ministries of churches

which do not possess or claim any "apostolic succession" based upon ordination at the hands of validly consecrated bishops.

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Episcopus, SIMON (1583–1643). Dutch theologian whose family name was Bishop. He was born at Amsterdam, Jan. 1, 1583, and educated at Leyden, where he came under the influence of Arminius (*q.v.*). In 1612 he was appointed to a chair at Leyden university, and became recognized as the leader of the Arminians against the Calvinists. He took a prominent part in the synod of Dort in 1618, with the result that he was deprived of office and had to live for a time in France. About 1626 he returned to Holland, and became rector of the Remonstrant College at Amsterdam, where he died April 4, 1643. His *Confessio*, *Apologia pro Confessione*, and *Institutiones Theologicae* are the standard works on Arminianism.

Episode (Gr. *epi*, on, in addition; *eisodios*, coming in). (1) In ancient Greek tragedy, that part of the dialogue which comes between the choric songs. (2) In music, part of a composition in which some departure is made from the main theme, or form, for the sake of variety. In the fugue form, the episodes allow the use of fragments of the subject matter, varied treatment of the subject, entries at irregular intervals of time and pitch, and free changes of key. In sonata and rondo forms, episodes are of the nature of second subjects, but of less importance than the true second subject which appears again fully in the recapitulation section. (See Rondo; Sonata.) (3) In literary composition, a minor event or incident introduced to give variety to a narrative, or to illustrate a character or event. A story, for instance, is said to be episodic when it consists of loosely knit incidents, or where the incidents do not merge together in a natural succession and harmonious whole.

Epistaxis (Gr. *epi*, on; *stazein*, to drip). Bleeding from the nose. This may be caused by injury, by an unhealthy mucous membrane, or it may be associated with influenza or some of the fevers. Local congestion due to a diseased

tooth can give rise to obstinate nose bleeding. The cause of recurrent nose bleeding is often a small network of varicose veins in the nasal mucous membrane, and this answers immediately to treatment with an electric cautery. Simple nose bleeding is usually stopped by applying cold compresses over the nose and to the nape of the neck. The nose should not be blown. The bleeding nostril should be plugged.

Epistemology (Gr. *epistēmē*, knowledge; *logos*, theory). Theory or science of human knowledge. It investigates the origin and limits of knowledge; defines the part played in it by experience and thought respectively; and examines the formation, meaning, and employment of its fundamental notions.

Epistle (Gr. *epistolē*, message, letter). Term generally applied in English literature to verses written in the form of letters addressed to specific persons, or to readers generally, as in the epistle dedicatory. In the former sense it was a revival of the use of the epistle by Horace and other classical poets. Satiric or moral epistles, such as Pope's *Essay on Man* and *Moral Essays*, more or less on the Latin model, were a notable feature of English literature in the 18th century, at the close of which Burns gave the epistle an easier and freer form.

There are examples of epistles in the O.T. and in the O.T. apocryphal pseudepigraphic writings; but the famous letters or epistles of the Bible are confined to the N.T. The chief writer is the apostle Paul, to whom thirteen Epistles are ascribed. These are commonly divided into four groups (1) 1 and 2 Thessalonians, written from Corinth in A.D. 52 or 53. (2) Galatians, 1 and 2 Corinthians, and Romans, written in A.D. 57-58. (3) Ephesians, Philippians, Colossians, and the Epistles of the (first Roman) Captivity, written in A.D. 62 or 63. (4) 1 and 2 Timothy, Titus, the Pastoral Epistles, so called because they are addressed to two pastors and deal with matters relating to the ministry, written in A.D. 65. The so-called Epistle to the Hebrews does not claim to have been written by Paul, though ascribed to him in the Eastern and later in the Western Church, and the description Epistle is hardly correct. Its author is unknown. It seems to have been written between A.D. 75 and 85.

The rest of the N.T. Epistles are commonly known as General or Catholic Epistles, because they are apparently addressed to Christians in general. They are: James, Jude, 1 and 2 Peter, 1, 2 and 3 John. The author of the Epistle of

James may have been the brother of the Lord. Jude describes himself as "servant of Jesus Christ" and "brother of James." Peter is the famous apostle. The First Epistle of John is closely related to the Gospel of John. The Second and Third Epistles claim to be written by "the Elder."

Epistolae Obscurorum Virorum (Letters of Obscure Men). Series of satirical letters addressed to Ortwinus Gratius and called into existence by the Reuchlin-Dominican controversy. They played an important part in the Reformation, and have been many times reprinted. The first part, consisting of 41 letters, was published in 1515, seven more letters being added in the 3rd edition, 1516. The second part, comprising 62 fresh letters, appeared in 1517; its 2nd edition, same year, contained eight more. The two series were not published in one volume until 1556. Their authorship, long in doubt, was established by W. Brecht, who proved the principal writers of Parts 1 and 2 respectively to have been Johann Jäger, called Crotus Rubianus, and Ulrich von Hutten. Consult text, ed. with Eng. trans. F. G. Stokes, 1909; Die Verfasser der Epistolae obscurorum Virorum, W. Brecht, 1904. See Reuchlin, Johann.

Epitaph (Gr. *epi*, on; *taphos*, tomb or grave). Inscription on a tomb. The desire to record in lasting form the virtues or great deeds of the dead is universal, and has found expression in all ages. Some of the earliest extant epitaphs are found on Egyptian sarcophagi, and they were commonly used among the Jews. One of the most famous Greek epitaphs is that recorded by Herodotus as having been inscribed in honour of the Spartans who fell at Thermopylae: "Stranger, go tell the Lacedaemonians that we lie here obedient to their commands." Various anthologies and the catacombs of Rome supply numerous Greek and Latin examples.

Epitaphs vary infinitely in style, and reflect the literary taste of their age. In England they range from the lengthy recital of the deceased's titles and dignities in Latin and the solemn and elaborate survey of his career in the English of the eighteenth century to the severely simple and the frankly humorous. An effective Latin epitaph is that on Sir Christopher Wren in St. Paul's Cathedral, London, *Simonumentum requiris, circumspice* (If you seek his monument, look around); while humorous epitaphs of the jesting sort frequently allude to differences between husband and

wife. Much ingenuity has been devoted to the play of words in epitaphs, e.g. in St. Benet, Paul's Wharf, London, is the following:

Here lies one More, and no more than he;
One More and no more.—how can that be?
Why, one More and no more may lie
here alone;
But here lies one more, and that's more
than one.

Unconscious humour due to carelessness or ignorance is occasionally found, as on a tombstone at Ventnor:

Here lies the body of Samuel Young, who
came here and died for the benefit of
his health.

Frequently, however, epitaphs of the humorous kind are not genuine, being composed as a form of literary amusement. Some of fine quality come almost under the head of epigrams. Such are most of the epitaphs in Ben Jonson's works; for instance, the lines Underneath this sable hearse, and the beautiful tribute to Elizabeth L. H.:

Would'st thou hear what man can say
In a little? Reader, stay.
Underneath this stone, doth lie
As much beauty as could die;
Which in life did harbour give
To more virtue than doth live:
If at all she had a fault,
Leave it buried in this vault.
One name was Elizabeth,
Th'other let it sleep with death;
Fitter, where it died to tell,
Than that it liv'd at all. Farewell.

Epithalamium. Nuptial song in praise of a newly wedded pair and invoking blessings on them, sung before the bridal chamber (Gr. *thalamos*). Fragments of Greek epithalamia by Anacreon, Pindar, and others have been preserved. One of the most celebrated by Latin poets is the epithalamium on Peleus and Thetis by Catullus. In English literature Spenser's *Prothalamium* and *Epithalamium* are among the most beautiful poems of this kind.

Epithelioma. Form of cancer in which the growth is mainly composed of cells pertaining to the epithelial or surface layer of the skin or mucous membrane. See Cancer.

Epithelium (Gr. *epi*, on; *thēlē*, nipple). Tissue composed almost entirely of cells with little cementing material. It forms the superficial layer of the skin and lines the internal cavities of the body. Pavement epithelium, consisting of one layer of cells fitted together like a mosaic, is found in the air-sacs of the lungs. Columnar epithelium lines the stomach and intestines. Stratified epithelium consisting of numerous layers of cells, covers the surface of the body. Ciliated epithelium is a form in which the surface of the cell carries a bunch of fine filaments having a continuous movement which sets up a current over the surface of the tissue. This form occurs in the air passages where the ciliary movement helps to clear the tissues of fine particles of foreign material and other debris.

Epithermal Deposits. Geological term used in the classification of ore deposits (after Lindgren). The large group of ore bodies genetically associated with igneous rock have been subdivided into several groups, according to the evidence of mineral association and geological relations. Epithermal deposits are considered to have formed from ascending thermal solutions at slight depth beneath the surface, generally at temperatures up to 200° C., pressures up to 100 atmospheres. Examples are found in the gold and silver deposits of Nevada, certain gold telluride veins, and the typical mercury deposits. Epithermal deposits frequently contain rich shoots (bonanzas) but rarely persist to great depth. It is, therefore, important for the mining engineer to know to which group his ore body belongs.

Epithermal deposits are generally associated with igneous lavas and dyke rocks, often andesite, latrite, trachyte, and rhyolite. The veins are characterised by crustification, brecciation, and open cavities. Wall rock alteration occurs, but much of the ore is confined to the vein. Short, irregular veins are the most common type. The metalliferous minerals may include those of gold, silver, mercury, base metals, tellurium, etc., while the common gangue minerals are quartz, calcite, barytes, fluor spar, adularia, manganese minerals, etc.

Epizoa. Term for the animals which live parasitically upon, and are commonly attached to, the bodies of other animals. The term is most commonly used for those parasitic upon animals which are themselves parasitic.

Epoch (Gr. *epochē*, pause). In astronomy, the date on which the position of a moving celestial

object is specified. For planets and comets, the epoch usually given is that of the passage of the object through perihelion (*q.v.*). Even for the so-called fixed stars, catalogues are made for a specified epoch (*e.g.* 1875, 1950), so that by applying proper motion (*q.v.*) the position of any particular star can be found for any other time.

Epode (Gr. *epi*, on; *ōdē*, ode). Third part of the triple system of the Greek ode, which consisted of strophē, antistrophē, and epode. The term subsequently came to be loosely used in a wider significance, being applied to certain of the lyrics of Archilochus and his imitator Horace. *See* Ode.

Eponym (Gr. *epi*, on; *onoma*, name). Name of a real or fictitious person, the reputed founder of a country or people. Such are the mythical Brutus, from whom the name Britain is supposed to be derived, and Hellen, the traditional founder of the Hellenes or Greeks.

Eponym Canon. The Assyrian chronological table. The Sumerians named each year by a significant local event. In the Assyrian records, years were named after official personages in an orderly sequence, after the analogy of the Greek archon (*q.v.*). The king was eponym in his first year, followed in succeeding years by his commander-in-chief, court officials, city governors, and other important persons. Inaugurated in the second millennium or earlier, the canon hitherto recovered comprises fragmentary name-lists from Nineveh and elsewhere dated continuously from 893 to 666 B.C. and discontinuously from 911. From a supplementary list mentioning important events as well, an eclipse record was dated by astronomical calculation June 15, 763, thus fixing the whole series.

Epping. Market town and urban district of Essex. It stands on the summit of a hilly ridge, 382 ft. above sea level, near Epping Forest, 17 m. N.E. of London by railways and Green Line buses. The church of S. John Baptist (1832) was rebuilt in 1890 and superseded All Saints at Epping Upland as the parish church in 1889. Its tower was added in 1908. Epping has an agricultural trade. Under the 1948 redistribution, it gives its name to a county constituency. Market day, Mon. Pop. (1951) 6,937.

Epping Forest. Stretch of wild woodland in Essex, England. All that remains of the old Royal Forest of Essex, known after the 13th century as the Forest of Waltham, it consists of about 6,800 acres between Leytonstone, S., and Epping, N., with Loughton, E., and Chingford, W., on high ground between the valleys of the Lea and Roding. The best of the wooded section includes Monkwood, N.W. of Loughton, and Epping Thicks, N.W. of Theydon Bois. Dark brown fallow deer run wild; a few small roe deer were introduced from Dorset in 1883. The last of the old red deer were removed to Windsor in 1827. Rabbits are numerous, and badgers, foxes, squirrels, and weasels are found.

While the pollarded hornbeam is a striking feature, there are a few aged oaks, and the beech, blackthorn, crab-apple, birch, willow, holly, and brushwood, together with gorse, broom, wild rose, and honeysuckle, lend charm and variety to the landscape. Of two ancient camps, Ambresbury Banks, 2 m. N. of Loughton, is popularly assigned to Queen Boadicea; and Loughton Camp, about 11 acres, to early British or pre-Roman origin. After protracted legal proceedings Epping Forest was secured to the public by the City Corporation and the Commons Preservation Society, at a cost of £250,000, and was opened by Queen Victoria, May 6, 1882. It is controlled by the City Corporation. A study of Epping Forest and its associations by W. Addison appeared in 1945.

Epsom. Market town forming with Ewell a borough of Surrey, England. It is situated 14 m. S.W. of London and is served by electric railway, bus, and Green Line. First known for its mineral springs accidentally discovered in 1618 by Henry Wicker when grazing his cattle, the town became a fashionable spa in the 17th century



Epsom. High Street of this Surrey market town, once a fashionable spa, but now best known for the race meetings on the adjacent downs

and was visited by royalty and London society, being especially popular about 1690. S. Martin's the parish church, has works by Flaxman and Chantrey. Epsom College is a public school, especially associated with the medical profession. Near the town is The Durdans, seat of a former Prime Minister, the 5th Earl Rosebery.

Epsom is world-famous for its race meetings held on the downs. Here the Derby, the Oaks, and other races are run and there are several large racing stables around. The town has some industries and gives its name to a county constituency. Pop. of Epsom and Ewell bor. (1951) 68,055.

Epsom Salts. Magnesium sulphate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$). It crystallises in small rhombic prisms, and forms a useful saline purgative.

Epstein, SIR JACOB (b. 1880). British sculptor. Born of Russo-Polish parents in New York, Nov.



Sir Jacob Epstein,
British sculptor

10, 1880, he lived in the U.S.A. until 1902, when he went to Paris to study at the Beaux Arts. Settling in London three years later, in 1908 he designed 18 figures for premises built in the Strand for the B.M.A. (later acquired by the N.Z. govt.). These aroused furious controversy, and established his reputation as a sculptor whose inspiration deriving from works of the past was interpreted with a new and startling vision. Influenced by Rodin, African primitive sculpture, and statues of



Epstein. Portrait head in bronze, exhibited by the sculptor at the Leicester Galleries, London 1947



Epstein's Lucifer, an over life-size bronze figure exhibited in 1945

the earliest Egyptian dynasties, Epstein's work was attacked not only for its austerity but for its revolutionary implications. In 1909 he designed the Oscar Wilde tomb in Paris. One of his most important works, the bas relief

Rima, erected in Hyde Park in 1925 as part of the birdsanctuary aid out as a memorial to W. H. Hudson, the nature writer provoked a storm of criticism, due chiefly to the distortion of the human figure. It was several times defaced. His other impressive works included the colossal figure groups of Night and Day at Broadway House, Westminster, 1928-29; Genesis, 1931; Ecce Homo, 1933; Consummatum Est, 1937; Adam, 1939; Jacob and the Angel, 1942; a Madonna and Child for the Convent of the Holy Child, Cavendish Square, London, 1952; and a vivid bronze statue of Smuts, unveiled in Parliament Square, London, 1956, all in one way or another challenging convention while they commanded respect. Epstein also executed portrait busts in bronze, e.g. of Conrad, Rothermere, Shaw, and Einstein.

He was knighted in 1954. The Tate, London; the Metropolitan Museum, New York, and other galleries possess works by him. He pub. *The Sculptor Speaks*, 1931; *Let There be Sculpture*, 1940; an autobiography, 1955.

Epstein, MORTIMER (1880-1946). British editor. Born of Jewish parents in Lithuania, he was brought to Great Britain as a child. He was educated at the Jewish theological college at Breslau, and later graduated at Heidelberg. Returning to England, he was economic adviser to several prominent commercial undertakings. In 1919 he became editor of the *Statesman's Year Book*, and in 1921 of the *Annual Register* (q.v.), retaining both positions until his death June 23, 1946.

Epworth. Market town of Lincolnshire, England. It is on the Isle of Axholme, 9 m. N.N.W. of Gainsborough and 24 m. of Lincoln. It is famed as the birthplace



Epworth. Interior of the Wesley Memorial church built in 1889 to commemorate the birthplace of John Wesley

of John Wesley, whose father was rector here. The parish church's maple wood mazer was purchased by the British Museum, June, 1947. Pop. 1,795.

Equaliser. In engineering a bar which serves to equalise a pull or thrust, applied at an intermediate point equally between its two ends. *See* Compensating Beam.

Equation (Lat. *aequare*, to make equal). Statement of equality between two quantities. Thus $19 + 6 = 25$ is an arithmetical equation. In algebra an equation is usually a statement involving known and unknown quantities,

the knowns being denoted by the earlier letters of the alphabet, a, b, c , and the unknowns by the later letters x, y, z . $ax=b$ is a simple algebraic equation, x being the unknown quantity, a and b being supposed known. If $a=6$ and $b=42$ then $x=\frac{b}{a}=\frac{42}{6}=7$.

Equations involving a number of unknowns, x, y, z , may form a system, and are then called simultaneous equations.

$$ax+by+cz=d$$

$$ex+fy+gz=h$$

$$kx+ly+mz=n$$

are simultaneous equations, and the problem is to find values of x, y , and z which will satisfy all three equations.

The degree of an equation is indicated by the highest power of one of its unknowns. Thus in the equation $ax^2+by=c$ the highest power of the unknown x is 2, and the equation is said to be of the second degree. An equation which is true for any values whatever of the quantities concerned is called an identity, and the connecting symbol is usually three parallel straight lines:

$$x^2-y^2=(x-y)(x+y)$$

is an example.

There are as many solutions to an equation as the degree of the unknown. An equation of the second degree has two solutions, an equation of the third degree three, and so on. The methods of solving equations up to and including the fourth degree are well known, and it has been proved impossible to obtain the algebraic solutions of equations of a higher degree. The symbol \equiv was first used by Recorde (1510-58). See Algebra.

CHEMICAL EQUATIONS. The change which occurs in a chemical reaction is represented by formulae and symbols which show the distribution of the molecules of the reacting bodies before and after the change. The elements are represented by symbols and atomic weights, and the sum of the weights of the original substances equals the sum of the weights of the products of the reaction: hence the representation is termed an equation. Chemical equations merely express symbolically the verified results of the action of different molecules upon each other. Berthollet formulated the conditions as regards solutions as follows:

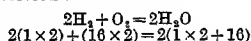
1. When two or more substances are brought together in solution, a substance will form and separate as a precipitate, if by any rearrange-

ment of the atoms a product can be formed which is insoluble in the liquid.

2. When two substances are brought together in solution, if a gaseous body or one that is volatile at the temperature of the experiment can form, it will escape as a gas or vapour.

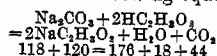
For example: When silver nitrate solution and hydrochloric acid are mixed, the insoluble silver chloride is formed as a white precipitate (1); when vinegar is added to a solution of washing soda (sodium carbonate) a brisk effervescence results from the carbon dioxide given off (2).

The equation representing the formation of water (H_2O) from its elements (hydrogen and oxygen) is written:



This equation symbolises the formation of two molecules of water from two molecules of hydrogen and one molecule of oxygen. The numbers beneath the symbols are the parts by weight of the elements involved in the reactions. The equation, however, does not tell us the conditions of the experiment; in this case a more mixing of the gases does not result in a reaction, it is necessary to cause them to combine by means of an electric current.

As another example, the reaction between washing soda and vinegar may be used. Washing soda is sodium carbonate (Na_2CO_3), with ten molecules of water of crystallisation which need not be shown in the equation. The acidity of vinegar is due to the acetic acid it contains. The formula for acetic acid can be written in several ways, e.g. $HC_2H_3O_2$; $C_2H_4O_2$; CH_3COOH ; or $C_2H_3.OH$. Taking the first expression as most suitable, we obtain the following equation:



On the right hand side results are shown, sodium acetate (which remains in solution), water, and carbon dioxide. We have thus accounted for the products of the reaction in accordance with the doctrine of the indestructibility of matter. The sums of the molecular weights on both sides are equal (rounded figures have been used), showing that all the atoms are accounted for.

In astronomy, an equation is a small correction added to or subtracted from a numerical quantity to compensate for a known irregularity or error. Thus, equation of

time, or personal equation, the correction applied to allow for a habitual inaccuracy of observation by a given person.

Equation of Time. A solar day is the interval which elapses between two successive passages of the sun over the meridian of a given place (e.g. London). Owing to the obliquity of the ecliptic to the equator, and to the varying velocity of the earth in its orbit, this interval is not always the same. Hence solar time differs from the mean solar time, registered by a perfectly even-going clock, constructed so as to record 24 hours to a mean solar day. There will be a difference between noon as registered by a sundial and as registered by the clock, and the difference will vary from day to day. This difference is called the equation of time, and is tabulated day by day in almanacs. Its maximum value is $16\frac{1}{2}$ mins. about Nov. 3. See Horology.

Equator (Lat. *aequare*, to equalise). Circle drawn round the globe midway between the N. and S. poles. At the equator the sun is seen directly overhead at noon at the equinoxes. Latitude is measured N. and S. of this circle. It is the longest line, in one plane,

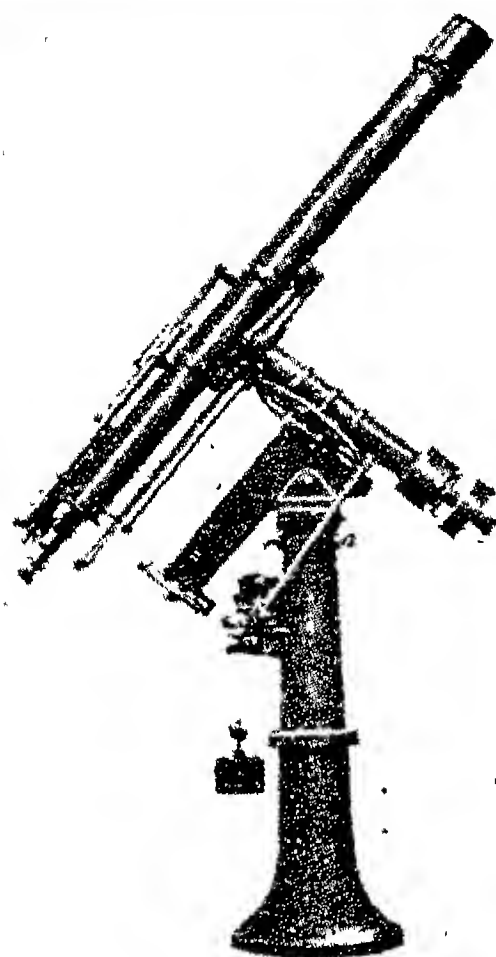


Equator. Perspective view of the earth, showing where the equator cuts Africa and a portion of S. America

that can be drawn round the earth, measuring approximately 24,902 m.

Strictly speaking, this line is the terrestrial equator. The great circle in which the plane of the terrestrial equator cuts the celestial sphere is called the celestial equator. The magnetic equator is that line drawn round the earth at any point on which the vertical components of the force of the earth's magnetism is zero. See Earth; Equinox; Latitude.

Equatorial. Telescope mounted and driven so as to follow the stars from rising to setting. The mounting consists of a polar axis, set



Equatorial telescope mounted to enable the observer to follow the heavenly bodies across the sky
By courtesy of T. Cooke & Son

parallel to the earth's axis in bearings so arranged that it can be rotated once in 24 hours by clock-work or electric motor. At right angles to this, a declination axis carries the telescope tube itself. The tube can be rotated by hand about the two axes until the telescope points to any desired star; the drive will then exactly counteract the effect of the earth's rotation and keep the telescope pointed towards the star indefinitely whilst observations are made. All big modern telescopes are mounted equatorially. The biggest, the 200-in. reflector on Mt. Palomar, Calif., has a cradle-type polar axis with the telescope tube slung within it between two declination bearings. With a solid upper bearing such as that of the 100-in. reflector at Mt. Wilson Observatory, the telescope cannot reach the polar regions. In lighter instruments such as the 72-in. reflector at Victoria, B.C., or the 40-in. refractor at the Yerkes Observatory, the declination axis carries the telescope at one end and a counterpoise weight at the other; this doubles the weight on the bearings, but is simpler to make and use. See Observatory; Telescope.

Equatorial Africa, FRENCH. Territory comprising Gabun (Gabon), Middle Congo colony, Ubangi-Shari, and Chad. Adjoining on the N.W. are French Cameroons; on the S., Belgian Congo; on the E., Republic of Sudan; on the N., Libya. French acquisition on the Gabun river began in 1839;

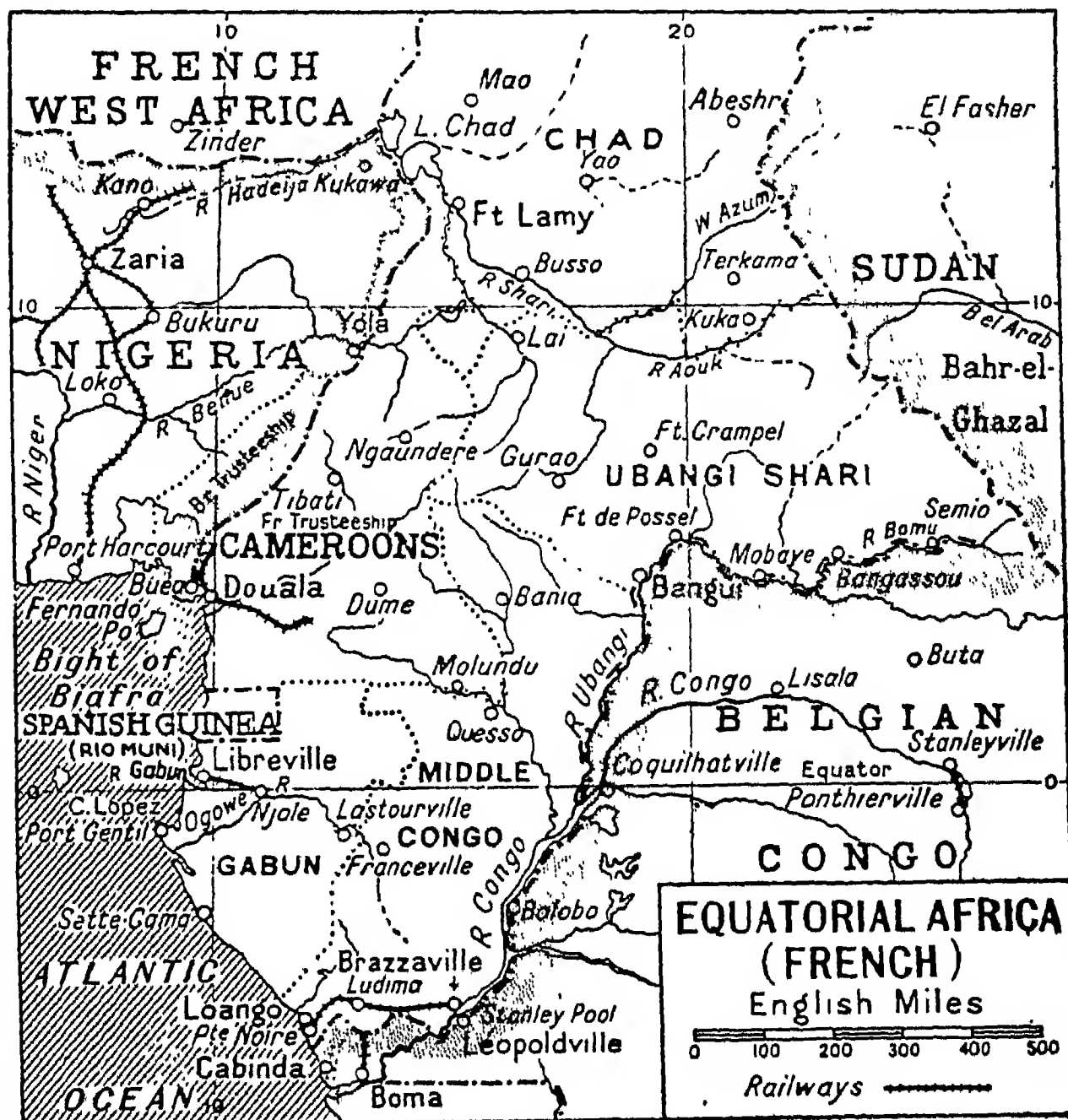
Libreville was founded in 1848, and Cape Lopez was gained in 1862. Since then the territories have been enlarged by exploration and military occupation, and their boundaries have been defined in a series of international conventions. By a decree of 1934, French Equatorial Africa was constituted a single administrative unit, the headquarters of the governor-general being at Brazzaville (*q.v.*). It was made a colony in 1941. The chief ports are Port Gentil, Libreville, and Pointe Noire. The principal products are cocoa, coffee, cotton, palm kernels, ground nuts, and timber; while copper, zinc, gold, lead, diamonds, corundum, and tantalum are found. Whale fishing is an industry. Area 959,256 sq. m. Pop. 4,490,000.

This vast area broke with the Vichy government in Aug., 1940, during the Second Great War, and with British West and East Africa formed a block of Allied territory stretching across the continent and providing a vital life-line from Great Britain and the U.S.A. to the Middle East at a time when the Mediterranean was closed to the Allies. Roads were constructed, linking the Atlantic coast ports with Egypt and the Sudan, and air bases were built across the territory, making it possible for air-

craft to be ferried across Africa to the operational areas. The opening of the trans-Sahara road in May, 1943, linked French N. Africa with Chad. See Cameroons; Chad; Gabun; Ubangi Shari. Consult Exploration and Adventure in Equatorial Africa, P. B. du Chaillu, new ed. 1945.

Equerry. Originally an official of the royal stables. In the British royal household the equerries are army officers in the department of the master of the horse. The chief or crown equerry is a permanent official, who looks after the stables and stud. The sovereign always has an equerry in attendance. The form of the word, originally meaning stable (Fr. *écurie*, late Lat. *scuria*), has been influenced in English by a supposed connexion with Lat. *equus* (horse).

Equidae (Lat. *equus*, horse). Family of ungulate mammals, including the horses, asses, and zebras. In geological history, the horse family can be traced back to ancestors that had five toes instead of the single toe of modern horses. Phenacodus, a five-toed animal about the size of a bull-dog, lived at the beginning of the tertiary period. The next stage is seen in Hyracotherium, which was about the size of a fox, with four equal toes on the fore limbs, found in



Equatorial Africa, French. Map of territories which in 1934 were constituted a single administrative unit, and in 1941 were made a colony

lower Eocene strata. Succeeding stages are represented by Anchitherium, with three toes and a diminutive fourth, in the Miocene age in Europe; Hipparion, with one large middle toe and two smaller side toes, in the Pliocene age; and Equus, two diminutive toes on each side of the large toe, in the Pliocene age. See Horse.

Equilibrium (Lat. *aequus*, equal; *libra*, balance). In a system of forces a state of equilibrium exists when the forces under consideration are so arranged that they balance or have no resultant at any point. A body is in stable equilibrium when it returns to its original position after being disturbed; in unstable equilibrium when it continues to move in the direction given to it by a disturbing force.

CHEMICAL EQUILIBRIUM. This is a balanced action between chemicals similar to that indicated by equilibrium in mechanics. It most closely resembles the mechanical equilibrium established when friction is large or inertia small, because in a chemical system there is nothing corresponding to the oscillations in mechanics. See Dynamics; Motion.

Equilibrium Diagram. This device of metallurgists is explained under Constitution Diagram.

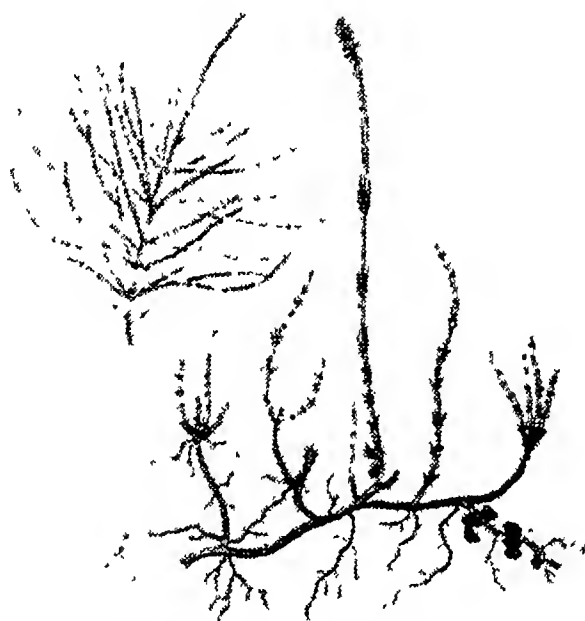
Equinoctial Gales (Lat. *aequus*, equal; *nox*, night). Term indicating a belief that gales normally occur about the equinoxes. (*v.i.*). Actually, in N. America and Europe and over the N. Atlantic Ocean, winter is the period of most frequent and most intense gales.

Equinox. Dates on which the day and night are of equal length, and the length of day is the same for all parts of the world. Twice a year—at the vernal equinox, March 21, and at the autumnal equinox, Sept. 23—all places on the earth experience a day and a night each twelve hours long, the sun is vertically over points on the earth's equator, and it rises due E. and sets due W. everywhere.

The plane of the earth's equator infinitely produced cuts the celestial sphere in a fixed great circle which is called the celestial equator. At the points where the plane of the ecliptic (*q.v.*) cuts the plane of the equator, or, more precisely, when the earth in its annual path is at these points, it will be so placed with regard to the sun that all over the earth day and night will be equal in length.

Equisetaceae (Lat. *equus*, horse; *seta*, bristle). Small family of Pteridophytes. It consists of

the single genus *Equisetum*—the horsetails. They are mostly natives of the N. temperate regions, but a few are sub-tropical. They have creeping rootstocks from which arise the erect, hollow, jointed stems, which are round and finely grooved. They are solid at the joints, which have toothed sheaths into which the next joint fits and from which the branches are given



Equisetaceae. Fertile and barren stems of the horsetail

off in whorls. The spores are produced on the undersides of scales of a terminal oval cone. *E. martii*, a native of Brazil, attains a height of 30 ft., but the other species are only a few feet high. The stems are covered with silica, and those of *E. hyemale* constitute the Dutch rushes of commerce, used for scouring and polishing.

Equitable. British life assurance company, in full the Equitable Life Assurance Society. Founded in 1762 as the Society for Equitable Assurance in Life and Survivorship, it is one of the oldest of the kind. In 1892 it was registered as a company. It is what is known as a mutual office, *i.e.* it has no shareholders, all profits after the payment of expenses going to policy holders. It has a controlling interest in the University Life Assurance Society and the Reversionary Interest Society. The head office is 19, Coleman Street, London, E.C.2

Equitable Charge. In English law, a charge on property which formerly was not enforced by a court of common law, but only by the court of chancery. Wherever the chancery court found an intention in a document that a sum of money should be secured on property, or paid out of it, the court would enforce it as a charge. For instance, if A owes B money, and gives B a letter saying "I will pay you out of the money due to me by C," this is a charge on C's debt, and the court will restrain C from paying the debt to A with-

out satisfying B's claim. Today all courts recognize and enforce equitable charges.

Equitable Estate. In English law the legal ownership of property may be vested in one person, and the equitable ownership in another. Thus a trustee is the legal owner of the trust property, but the beneficiaries have the equitable estate.

Equites (Lat., horsemen). In ancient Rome, originally citizens wealthy enough to support the expense of serving as horse soldiers. With lapse of time, as the citizen militia gave way to a paid army, the *equites*, conventionally translated knights, became merely a class in the state possessed of a certain amount of wealth, ranking below the senatorial order, but above the common people. As senators were forbidden to engage in trade, this equestrian order tended to be composed largely of merchants and other tradesmen.

The farming of taxes was an equestrian privilege, and at one time jurymen were exclusively drawn from the ranks of the knights. Under Augustus the order became more sharply defined; certain posts in the state service were reserved for them, the most important being the governorship of Egypt, the commissionership of corn supply, and the command of the fleet. The originally military associations of the equites survived only in state ceremonies. *Pron.* ek-wit-eez.

Equity (Lat. *aequitas*). Term used by English lawyers to describe that part of the law of England formerly enforced only by the court of chancery, and not by the common law courts. Equity was of two kinds: (1) where the court of chancery gave rights which the common law courts did not give; and (2) where chancery gave remedies which the common law knew nothing about.

Equitable rights unknown to the common law were numerous. The common law knew nothing of trusts and trustees. If a man had property conveyed to him, he was the legal owner, but if the property had been conveyed to him to be applied for the benefit of another, the chancellor would enforce the trust. The chancellor's jurisdiction was said to be founded on conscience. Gradually, side by side with the common law and sometimes conflicting with it, a great system of equity or chancery law grew up. When rights at common law and rights in equity did so conflict, the chancery court would grant an injunction to restrain the defendant

from exercising his legal rights—that is, from bringing or going on with a common law action to enforce those rights. Since the Judicature Act, 1873, all courts administer common law and equity side by side, so that such injunctions are now unnecessary.

Equitable remedies unknown to the common law were invented by the chancellors. The chief were the injunction and specific performance. The latter compels a man to carry out the contract he has made, and does not allow him to break it and pay damages. This jurisdiction was founded on the inadequacy of the remedy at common law, whose one and only panacea for every wrong and every breach of contract was damages. On the same principle the chancellor would grant an injunction to restrain a breach of contract, or the continuance of a wrong, or the commission of a threatened wrong, where damages would be an inadequate remedy. Thus, if I had a right of way over a footpath across A's field, and A stopped up the path, at common law I would get damages; but in equity I would have an injunction to restrain A from continuing to obstruct the path; and if A disobeyed, he would be attached. Equity, however, would not grant specific performance of every contract, or grant an injunction to prevent every wrong; but only when the remedy in damages was inadequate.

At common law there was no discovery, and, until comparatively recently, neither plaintiff nor defendant, nor anyone privy to them in blood or estate, was allowed to give evidence. This did not apply in the chancery court. So a common law plaintiff or defendant used to "file a bill" for discovery. That is, he made the other side answer on oath as to what documents he had in his possession. Also he could ask a long string of questions about the common law action, and compel the other side to answer them in writing and on oath. This procedure is now obsolete, as all courts, even county courts, have power to order discovery and interrogatories.

The principal subjects of the equitable jurisdiction are the enforcement and administration of trusts, the winding-up of partnerships; the administration of deceased persons' estates; the guardianship and property of infants; injunctions; the specific performance of contracts; the taking of accounts; the rectifica-

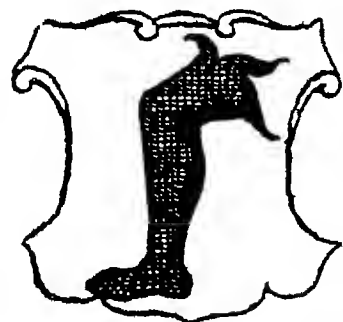
tion, setting aside, or cancellation of deeds or other written instruments, on the ground of mistake, misrepresentation, fraud, or undue influence; and the partition or sale of real estates.

At one time a court of equity could not award damages. They were reserved for the courts of common law. By the Judicature Act, 1873, however, all branches of the high court can now award damages in proper cases; though it is still unusual to bring an action for damages alone in the chancery division. See Jurisprudence: Law.

Equity. British actors' association. Founded 1930, and administered by a council elected annually, this organization represents and safeguards the interests of actors, singers, dancers, ice-skaters, and others engaged in all branches of live entertainment, films, and broadcasting. In 1955 the annual subscription was £3, membership just over 10,000. In the U.S.A. a similar body, Actors' Equity Association, was formed in 1913.

Equuleus (Lat., young horse). One of the Ptolemaic constellations. It is a small group of stars close by the head of Pegasus, so placed as to suggest that another horse is galloping by Pegasus.

Era or **ABRA.** In chronology, a fixed point of time from which years and historical events are reckoned. Generally the date of some decisive occurrence in the history of the world, or of a particular people or individual, it also denotes the series of years reckoned therefrom. Important eras are: the Jewish, from 3761 B.C.; the Greek Olympiads, from 776 B.C.; the Roman, from 753 B.C., the traditional date of the foundation of Rome; the Babylonian, that of Nabonassar, 747 B.C.; the Spanish from 38 B.C., the conquest of Spain by Augustus; the Christian; the Mahomedan, 622. See Chronology.



Erased in heraldry

generally said to be slipped if small, or snagged if large.

Erasmus, DESIDERIUS (1466-1536). Dutch humanist. He was probably born at Rotterdam, Oct. 28, 1466, the illegitimate son of Gerard de Praet of Gouda. For the name Gerard, meaning well-beloved, he afterwards substituted

the incorrect Latin and Greek equivalents, Desiderius Erasmus. After four years' schooling at Deventer, he was sent by his guardians to a seminary of the Brothers of the Common Life at Hertogenbosch (Bois-le-duc), and in 1486



Erasmus

After F. Penn in the Royal Collection at Windsor

entered the cloister of Stein and took the vows of the Augustinian order. In 1491 he became secretary to the bishop of Cambrai and a priest in 1492. After spending some time at the Collège Montaigu in Paris, he returned to Cambrai, but resumed his studies in Paris in 1496. At the same time he took pupils, one of whom, Lord Mountjoy, invited him to England.

Residing chiefly at Oxford, he became the friend of Thomas More and Colet, and received instruction in Greek from Grocyn and Linacre. He re-visited England in 1506 and 1509, the last time at the invitation of Fisher, bishop of Rochester and chancellor of Cambridge university. He taught Greek in Cambridge, and was appointed Lady Margaret professor of divinity. Between his visits to England and for some time afterwards he led a wandering life. During 1521-29 he was at Basel, where most of his works were published, and during 1529-35 at Freiburg, whence he returned to Basel and died July 12, 1536.

Of his editions of classical works the most important is Terence, 1532. *Adagia*, 1500, and *Apophthegmata*, 1531, contain maxims and anecdotes from classical authors, accompanied by moral reflections; *Ciceronianus*, 1528, is an attack upon the Italian school of Latin prose writers, who refused to admit any words or phrases not found in Cicero. He edited many of the Fathers of the Church, but his greatest service to

theology was his edition of the New Testament, 1516, the Greek text with a Latin translation, his treatment of which entitles him to be called the pioneer of Biblical criticism. The *Enchiridion Militis Christiani* (Dagger or Manual of the Christian soldier), 1502, is an attack on the inefficacy of formal religion. Other famous treatises are *Encomium Moriae* (Praise of Folly), 1509, a satire on clerical abuses and human follies, and *Colloquia*, 1516, specially a castigation of the vices of priests and others. Much of his correspondence throws light on the manners and customs of the England of his day.

Erasmus has been much criticised for the part he played in the Reformation and his attitude towards Luther. "Erasmus laid the egg and Luther hatched it," it was said. The truth is that Erasmus was a scholar, not a theologian; he was not the stuff of which religious zealots or martyrs are made. To use his own words, "I am afraid if I were put to the trial, I should imitate S. Peter." While conscious of the faults of Roman Catholicism, he always remained a Catholic, and while acknowledging the need of religious reform, he clearly saw the dangers that would inevitably follow extremist efforts in that direction. See *Humanists; Renaissance*.

Bibliography. Collected Works, ed. J. Clericus (Le Clerc), 10 vols., Leyden, 1703-06. Lives, by R. B. Drummond, 1873, R. C. Jebb, 1890, E. F. H. Capey, 1902; C. Hollis, 1933; S. Zweig, 1934; The Epistles of E. (to his 51st year), Eng. trans., F. M. Nichols, 1901-04; *Opus Epistolarum Erasmi*, ed. P. S. Allen, 1906; The Age of Erasmus, P. S. Allen, 1914.

Erastianism. Term specially applied to the view of Church policy which regarded the Church as mainly or solely a department of the State. Its upholders urged that while the choice and practice of religion was a matter for the individual conscience, the external organization of churches—including the appointment of ministers—was a function of the State. In a general sense, Erastianism means the doctrines of Thomas Erastus.

Erastus, THOMAS (1524-83). Swiss theologian. His family name was Lieber or Liebler, of which Erastus (beloved) is the Greek form. Born Sept. 7, 1524, at Baden, Switzerland, of peasant origin, he studied theology at Basel, and medicine and philosophy at Padua. In 1558 he became professor of medicine at Heidelberg, and later of ethics at Basel, where he died Dec. 31, 1583. A strong opponent of Calvinism, he upheld the Zwinglian doctrine. In a post-

humorous work he maintained that offences of Christians should be punished by the civil power rather than the ecclesiastical. Consult *Theses of Erastus touching Excommunication*, Eng. trans. R. Lee, 1844. See *Erastianism*.

Erasure (Lat. *e*, out; *radere*, to scratch). Word meaning an obliteration, used mainly in connexion with written documents. In a legal document an erasure may be fatal to its validity, unless it can be proved that it was made before the document was executed. The parties concerned should initial the place where the erasure is made.

Eratosthenes (c. 284-204 B.C.). Greek geographer, mathematician, astronomer, critic, and poet. Born at Cyrēnē, he studied at Alexandria and then at Athens, whence he was summoned in 235 by Ptolemy Euergetēs to take charge of the library at Alexandria, a post which he held until his death. His chief work, *Geographica*, was a treatise on physical, mathematical (based on his method of measuring the earth), and political geography. His mathematical works included a treatise *On Means*; the *Koskinon* (sieve) was a mechanical device for finding prime numbers. He also wrote an astronomical poem, *Hermes*, a description of the heavens and the mythological legends associated with the stars; a *Chronographia* or *Annals*; a valuable list of the victors in the Olympic games; and a history of old comedy.

Erbium. Metallic element of the rare earth erbia, which is its oxide. Its atomic weight is 167.2, atomic no. 68, specific gravity 4.77, symbol Er. Though pure compounds have been prepared, the element has not yet been isolated. The oxide was first recognized in 1843. With dysprosium, holmium, and thulium it forms the erbia sub-group of rare earths, all of which are included in the yttrium group. Erbia is found in almost all the rare earths, but is most conveniently extracted from zenotine, fergusonite, euxenite, polychrase, and blomstrandin.

Ercilla y Zuñiga, ALONSO DE (1533-95). Spanish poet. He was a native of Madrid, and became attendant to Philip II, whom he accompanied to England in 1554. Ercilla fought in Chile against the Araucanians. The closing years of his life were lived in poverty and



Alonso de Ercilla y Zuñiga, Spanish poet

neglect. His poems are mainly heroic, notably *La Araucana*, which embodied his war experiences.

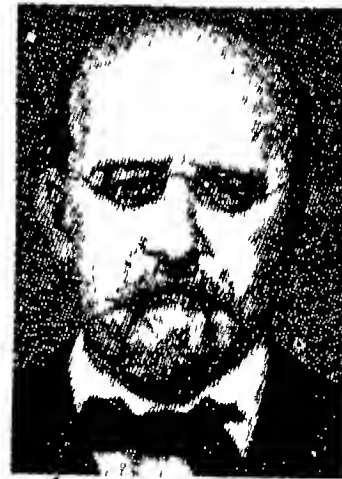
Erckmann-Chatrian. Compound signature of two successful literary partners and collaborators. They were Émile Erckmann, born

May 20, 1822, at Phalsbourg, Moselle, and Alexandre Chatrian, born Dec. 18, 1826, at Soldaten-thal, Meurthe. They began to collaborate in 1848, but first won success in 1859 with



Alexandre Chatrian, French author

L'illustre Docteur Mathéus. In 1862 they began, with *L'invasion: ou le fou Yégof*, a series of novels which included *Histoire d'un Conscrit* and *Waterloo*, which remain among the best war stories ever written. Industrious playwrights, also in collaboration, they wrote *Le Juif Polonais* (Théâtre Cluny, June, 1869), which



Émile Erckmann, French author

as *The Bells* became one of Irving's successes. Another of their plays, *L'ami Fritz*, 1876, retains its popularity in various modified forms. The collaboration was terminated by a difference of opinion on money matters. Chatrian died at Villemomble, near Paris, Sept. 4, 1890, Erckmann at Lunéville, March 13, 1899.

Ercole da Ferrara (c. 1462-1531). Italian painter. Born at Ferrara, little is known of him except that he was in the service of the Duke of Ferrara from 1492-99, and died in Ferrara in 1531. Among his best works, distinguished by the warmth of their colouring, are *The Madonna and Child*, and *Conversion of S. Paul* in the National Gallery, London. His real name appears to have been Ercole di Giulio Grandi, and his pictures have often been confounded with those of his fellow-townsmen and contemporary, Ercole di Roberti Grandi (c. 1455-96), probably his brother. The latter



Ercole da Ferrara, Italian painter

From an old engraving



Mt. Erebus. Sir Ernest Shackleton's camp 7,000 ft. up this Antarctic volcano. The steam from the active crater is visible on the mountain top

By courtesy of W. m. Heinemann

was obviously influenced by Mantegna in his earlier work at Bologna; his second style, adopted after he settled in Ferrara in 1486, was more suave and graceful.

Erebus (Gr. *erebos*, darkness). In Greek mythology, son of Chaos and father of Hemera (Day) by union with his sister Nyx (Night). The word is sometimes used as equivalent to the lower world generally, sometimes for the region through which souls passed on their way to Hades proper.

Erebus. Active volcano of Ross Island, off S. Victoria Land, Antarctica, in lat. 77° 30' S., alt. 13,000 ft., discovered by Captain James Ross in 1841, who named Erebus and the nearby Terror (*q.v.*) after his ships.

Erech. Biblical name of the Sumerian city Uruk (Gr. and Parthian Orchoë), on the left bank of the Euphrates, between Samawa and Shatra. It was traditionally the city of Gilgamesh (*q.v.*). The leading city in Mesopotamia, c. 2300 B.C., Uruk was still important in Hellenic and Parthian times. Excavations on the site by Loftus in 1849 and 1854, by Andrae in 1902, and by the German Oriental Society 1912-13, 1927-39, and from 1950 laid bare part of the vast mounds which cover its temples and palaces, with Inanna, the great temple dedicated to the goddess Inanna, and its ziggurat in the centre. Other temples include that of Anu and Antum, and a Kassite temple with façade of moulded brick. Important finds in the early, prehistoric levels were walls decorated with coloured cone mosaic, new types of pottery, and tablets containing the earliest known pictographic writing.

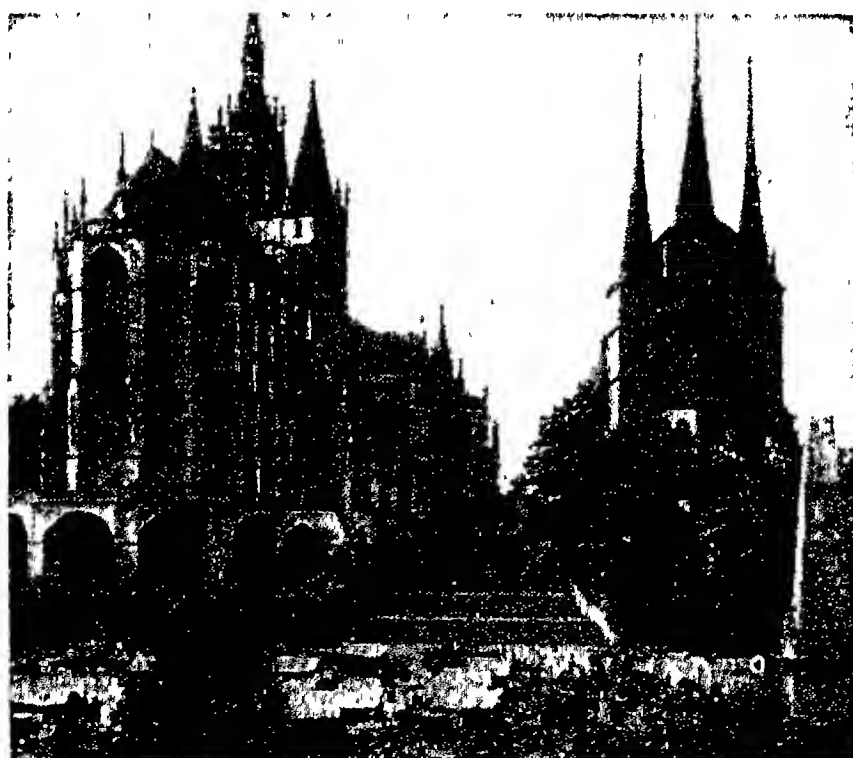
Erechtheum (Gr. Erechtheion). Ionic temple on the Acropolis, Athens, begun 421 B.C. or earlier, left unfinished, and completed

409-406. It contained the shrines of Athena Polias (replacing an earlier temple destroyed in 480) and Erechtheus, legendary founder of the city; the crypt with the mark of Poseidon's trident; the tomb of Cecrops; and other sacred objects. It is noted for the delicacy of its sculptures, its porch of the Caryatides (see illus. in p. 714), and its

frieze of white marble figures on a background of black limestone.

Erechtheus OR ERICHTHONIUS. In Greek mythology, legendary king of Athens. He was said to have been the founder of the great Athenian festival of the Panathenaea, and to have introduced the worship of Athena.

Eregli. Name of three Turkish towns, two in Asiatic Turkey and one in Thrace. (1) Port on the Black Sea, between the Bosphorus and Sinope, in Zonguldak vilayet. This was the ancient Heracleia, whence Xenophon's 10,000 Greeks set out on their return to Greece by sea. Sometimes called Banderegli, it is a busy place, with some shipbuilding and an export trade in silks, cattle, and coal. (2) Town in Konya vilayet, the ancient Cybistra. It stands on the Bagdad rly., halfway between Konya and Adana. There are remarkable Hittite remains in the neighbourhood. (3) Town of Thrace, on the European side of the Sea of Marmara, about 50 m. W.S.W. of Istanbul. It is also known as Eski Eregli and was the ancient Perinthus.



Erfurt. Left, Gothic cathedral church of Our Lady; right, the 15th century church of S. Severus

Eremurus. Genus of perennial herbs of the family Liliaceae. Natives of Asia, from S. Russia to Hindustan, they have fascicled roots, long slender leaves, and leafless flower stems terminating in a long spray of yellow, rosy, or white flowers, much like the hyacinth.

Eretria. Ancient city of Greece, on the W. coast of Euboea. It stood on the Euripus, 14 m. S.E. of Chalcis. It sided in 498 B.C. with the Greeks of Asia Minor against the Persians, who destroyed it eight years later. Rebuilt by the Athenians, it was the seat of a short-lived school of philosophy founded by Menedemus, whose tenets were akin to those of the Megarians. Eretria figured prominently in the war between Athens and Philip of Macedon. Recent excavations have revealed the remains of a theatre, an early temple, and other relics of the pre-Persian period. The site is now occupied by the swamp-bound town of Nea-Psara.

Erewhon OR OVER THE RANGE. Satire by Samuel Butler. One of the outstanding satires in English literature, this most popular of Butler's books was published 1872. When sheep farming in New Zealand, Butler wrote a sketch, Darwin Among the Machines (1863), and in this may be traced the germ of the imaginary country he depicts with such masterly incisiveness in the novel. In the manners and customs of Erewhon (nearly a reversed spelling of Nowhere), Butler satirised those of his own age; by placing the scenes and characters beyond time, he was able to draw a parallel with those of Victorian England. A sequel, Erewhon Revisited, notable for its humour, was published 1901.

Erfurt. A city of Germany. Largest town and chief economic centre of Thuringia, it stands 14 m. W. of Weimar, in the valley of the Gera, at the junction of many railways. Before the Second Great War its ancient buildings attracted tourists; the cathedral, dedicated to the Virgin Mary, mainly built in the 13th century, surrounded by towers of the old town, was one of the finest survivals of medieval architecture in Germany. There were 14 R.C. and 11 Protestant churches; the cathedral and neigh-

bouring church of S. Severus remained R.C. The former Augustine monastery where Luther lived, 1505-08, was turned into an orphanage, called in his honour Martinstift. The Predicants', Barefooted, and Augustine Friars' churches, now Protestant, date from the 13th and 14th centuries; and the university where Luther studied was built in 1392. The museum (1706) housed a unique collection of medieval art. Fortified until 1873, Erfurt's twin citadels dominated the city, the foundation of which dates from the pre-Charlemagne period, being made the seat of a bishopric by S. Boniface in 741.

Erfurt became an industrial centre early in the 19th century; it was famous for machinery, shoes, furniture, and rolling stock. Textile and chemical plants were developed; brewing and dyeing flourished, as did the flower seed trade. The former university influenced the whole of Germany from 1378 to 1806. Pop. (pre-war), 166,661.

During its early history Erfurt, though under the archbishop of Mainz, pursued an independent policy. The town council supported emperors in conflict with the Church, yet it never gained the status of a free city. From 1483 it came under the protection, then under the domination, of the Saxon dynasty. During the Thirty Years' War it became a Swedish stronghold, but in 1664 was recaptured by a Mainz archbishop. Ceded to Prussia in 1802, it was occupied in 1806 by Napoleon, who had met Tsar Alexander I there during the congress of 1800. Falling to Prussia in 1814, it was the scene in 1850 of the parliament of the short-lived N. German federation. During the Second Great War, the Germans made it a strong-point, and in its capture by the U.S. 3rd army it was largely destroyed. The Americans surrounded it April 11, 1945, but were counter-attacked four times. Next day, after a three-hour artillery bombardment and attacks by fighter bombers, the U.S. 80th div. launched an assault and cleared the city.

Erg. Unit of work; the work done when a body acted on by a force of one dyne moves one centimetre parallel to the line of action of the force. It is approximately the work done when a milligramme is raised through one centimetre. See Dyne.

Ergometrine OR ERGONOVINE. One of the most important alkaloids of ergot. Isolated in 1935 by Dudley and Chassar Moir after the

latter had previously proved the existence in ergot of an unknown alkaloid, ergometrine ($C_{19}H_{22}O_2N_3$) is readily soluble in water; this accounts for the activity of watery extracts of ergot. In medicine, a dose is $\frac{1}{120}$ to $\frac{1}{80}$ grain; by intramuscular injection, $\frac{1}{40}$ to $\frac{1}{20}$ grain; by intravenous injection, $\frac{1}{40}$ to $\frac{1}{20}$ grain. Its specific action is to initiate a long persistent rhythm of powerful contractions in a uterus normally quiescent. Clinically, ergometrine is remarkable for its rapidity of action; its greatest value is in the treatment of post-partum haemorrhage; in the control of excessive menstrual loss; and in the relief of migraine.

Ergot (Fr., spur). Fungoid pest (*Claviceps purpurea*) that attacks the flowers of cereals—especially rye—cultivated grasses, such as rye-grass and Timothy grass, and wild grasses. What should have been a grain is replaced by a hard spur-like outgrowth (ergot), which, if devoured by pregnant stock, may cause abortion. Ergots should not be sown with grain or grass seeds, and wild grasses infested by them should be destroyed.

The most important active principles of ergot are ergometrine (v.s.) and ergotoxine, which cause powerful contractions of the uterus. For this reason ergot or its preparations are sometimes administered after labour to ensure efficient contraction of the uterus and diminish the risk of post-partum haemorrhage. (Pituitary extract is more often used.) This property of ergot formerly led to its use to induce labour when desirable on medical grounds, but its action in this respect is uncertain.

Poisoning by ergot may be acute or chronic. Acute poisoning, which may result from taking a single large dose, gives rise to giddiness, vomiting, colic pains in the abdomen, disturbance of vision, cramps, muscular weakness, coma or delirium, and convulsions. Fatal cases are rare, but if the poisoning is associated with premature expulsion of the uterine contents the risk is much greater. Chronic poisoning is generally the result of eating, for a considerable period, bread which has been made from rye or other cereals infected with the fungus. Ergotism, as the condition is called, is not uncommon in Russia. The early symptoms are those of irritant poisoning: vomiting, diarrhoea, and pain in the abdomen. The latter symptoms present two types, the nervous and the gangrenous form. In the for-

mer there may be tingling sensations in the skin, spasms, and painful cramps in the muscles. Generalised convulsions resembling those of epilepsy may occur. Paralysis and affections of the mind, such as delirium, melancholia, or dementia, are other manifestations. The gangrenous form may lead to mortification of the fingers and toes. Both sets of symptoms may be present in one individual.

Eric, OR LITTLE BY LITTLE. Story for boys by Dean F. W. Farrar, first published in 1858, the author being aged 27. This record of the conflicts and tribulations of Eric Williams at Roslyn School stresses with some force and passion the temptations of life and the retribution that may overtake any who succumb to them. The book ran through 36 editions during Farrar's lifetime. Though ill-attuned to later tastes in juvenile fiction, it remains a classic often quoted, if only in mockery.

Eric XIV (1533-77). King of Sweden, 1561-68. Born Dec. 13, 1533, he was the son and unworthy successor of Gustavus Vasa. His short reign was marked by the limiting of the power of the royal dukes and by the securing of Estonia, which began Sweden's policy of oversea expansion. His insanity and cruelty cut short his reign, for after the murder of the Stores in 1567 the nobles rose and deposed him (1568). At different times he contemplated marriage with Elizabeth of England, Mary of Scotland, Christina of Hesse, and Renée of Lorraine, but finally contented himself with marrying his mistress, Katrina Månsdotter, a peasant. He is believed to have been poisoned in Feb., 1577, at the order of his brother and successor, John.

Eric THE RED (fl. c. 985). Norse voyager. From Iceland he explored the W. coast of Greenland, 982-985, and founded a colony there the next year. He named the country Greenland to attract settlers and called his village Brattahlid. The father of Leif Ericsson (q.v.), he was the hero of Eric the Red's Saga.

Ericaceae (Gr. *ereikē*, heath). Large family of evergreen shrubs, under-shrubs, and a few small trees. Native to temperate and cold climates, they have simple leaves and regular flowers. The family includes heaths (*Erica*) and rhododendron.

Erice. See Eryx.

Ericht. Loch on the borders of Perthshire and Inverness-shire, Scotland. Lying in desolate country 1,152 ft. above sea level, it is

14½ m. long and has a maximum depth of 513 ft. Overlooking the W. shore is Ben Alder (3,757 ft.). Here is a cavern in which Charles Edward sought refuge after the battle of Culloden. See Grampian Hydro-electric Scheme.

Ericsson, JOHN (1803-89). A Swedish-American engineer. Born July 31, 1803, in Vermland, Sweden, he de-



John Ericsson,
engineer

veloped great aptitude for mechanics, and in 1820 became an engineer in the Swedish army. Seeking a wider scope for his talents, he came to England and occupied himself with improvements in steam machinery. In 1829 he built, with John Braithwaite (*q.v.*), the Novelty locomotive engine to compete with Stephenson's Rocket. Ericsson was occupied with various inventions, chiefly marine engines, up to 1836, when he brought out a marine screw propeller.

Not obtaining the recognition he expected from the British Admir-

alty, in 1839 he went to America, where he lived for the remainder of his life. Turning his attention to defensive armour for warships and improvements in marine engines, he gained a wide reputation. In 1861 he designed the famous armoured turret ship Monitor for the American navy. He died in New York, March 8, 1889.

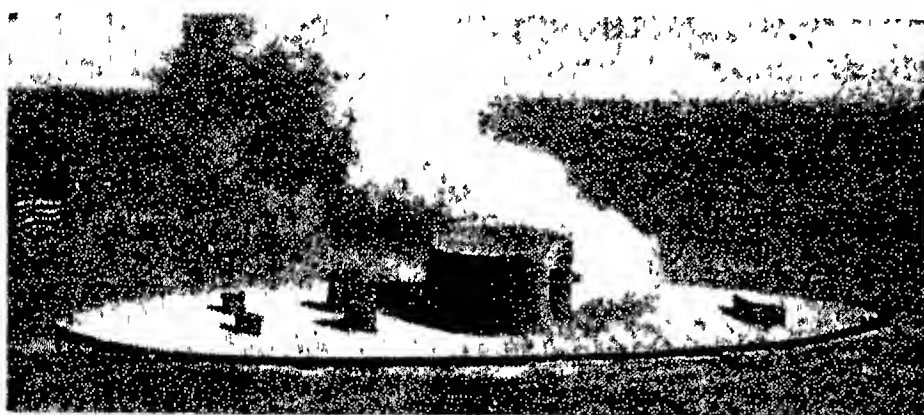
Ericsson, LEIF (*fl. c.* 1000). Norse voyager who discovered N. America, 1000. Son of Eric the Red, he was ordered in 999 by Olaf Tryggvason, king of Norway, to proclaim Christianity in Greenland. Driven off his course, he sighted and landed on "Vinland," probably Nova Scotia.

Eridanus. One of the Ptolemaic constellations. The larger part is below the S. horizon to an observer in N. Europe. The constellation is also called the River.

Eridge Castle. Seat of the marquess of Abergavenny in Sussex, near the Kentish border, 3 m. S. o' Tunbridge Wells. The estate has belonged to the Nevilles since the 13th century, but the present castle is 19th century. The park covers

2,000 acres. At Eridge Green are the denuded sandstone Eridge Rocks. The village has a railway station, and the place gives its name to the Eridge Hunt.

Eridu. Sumerian city of great antiquity, at Tell Abu Shahrain in the desert 14 m. S. of Ur (Muqayyar), traditionally the cradle of Sumerian civilization. As the Epic of Creation said: "All the lands were sea; then Eridu was made." It was the home of the water god Enki or Ea (*q.v.*). First identified by the soundings of Taylor in 1853-54, the site was dug by Campbell Thompson and H. R. Hall for the British Museum in 1919. Further excavations sponsored by the Iraq govt. in 1946 uncovered a prehistoric temple many times rebuilt, whose floor was littered with fishbones, the remains of offerings to Enki. Some 200 tombs contained fine painted pottery earlier than the Al Ubaid period.



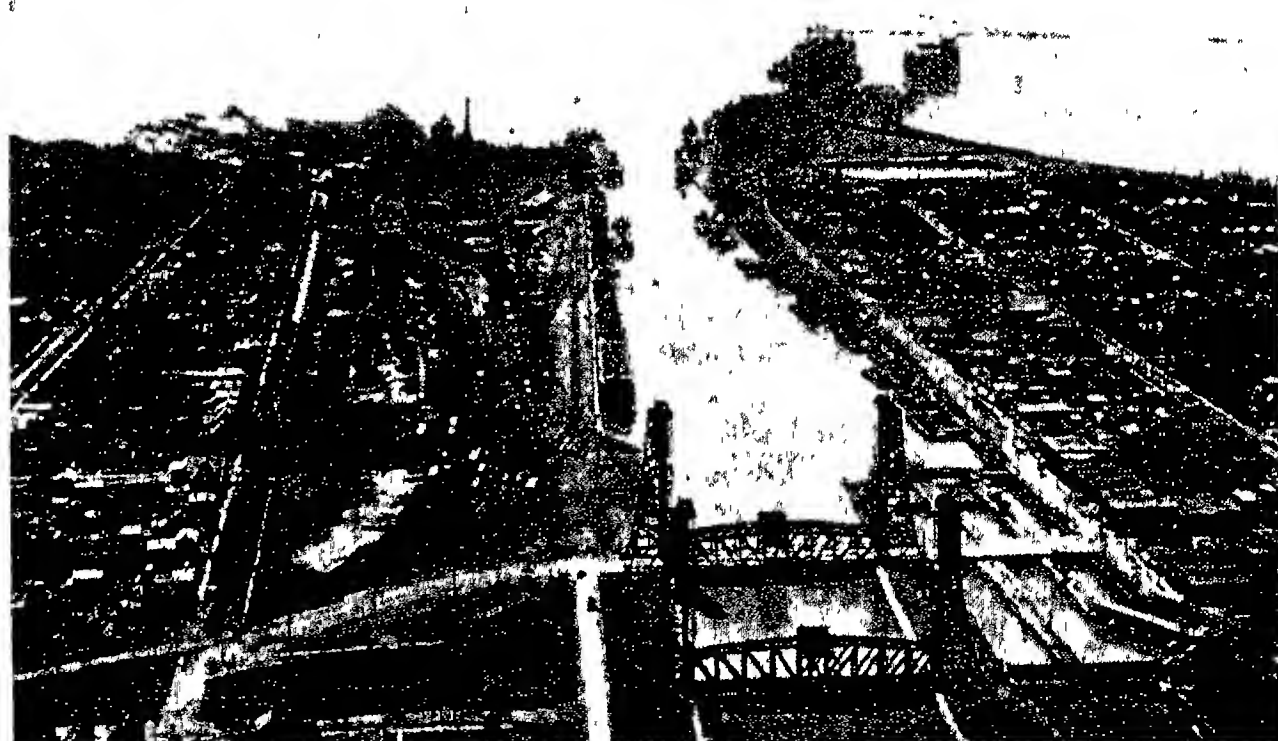
Ericsson. The Monitor, an ironclad turret ship, built from Ericsson's plans by the Federal navy during the American Civil War

Erie. Southernmost of the chain of great lakes in N. America. It forms part of the boundary between the U.S.A. and Canada. Area, 10,000 sq. m. It is 250 m. long, and its greatest breadth is 60 m., while its average depth is 90 ft. The lake is 565 ft. above the

level of tide water in the Hudson river at Albany, and 330 ft. above the level of Lake Ontario, into which it discharges its waters by the Falls of Niagara. At its N.W. end it receives the surplus waters of lakes Superior, Michigan, and Huron, through the river Detroit. Contributory feeders are the rivers Thames and Grand. A large number of steamers and other ships traverse it, except in winter, when it is generally frozen for a considerable period. In very hard winters it is possible to cross from the U.S.A. to Canada over the ice.

Lake Erie is the outlet of a large system of connecting canals, which render its navigation of great importance. The Welland Canal connects with Lake Ontario; the Erie Canal affords communication between Buffalo and Albany, thus linking up with the Hudson river; the Ohio Canal begins at Cleveland and ends at Portsmouth, on the Ohio river; and the Miami and Erie Canal connects Toledo with Cincinnati. During the war of 1812-15 an American squadron under Commodore Perry, captured here a British force of six vessels on Sept. 10, 1813.

Erie. City of Pennsylvania, U.S.A., the co. seat of Erie co. On Lake Erie, 88 m. S.W. of Buffalo, it is served by rlys. and an airport. The largest land-locked harbour on Lake Erie, with artificial improvements, it is protected by Presque Isle, a strip of land 6 m. long and 1 m. in extreme breadth, and has a maximum depth of 25 ft. An industrial and commercial centre with a valuable trade by lake and rly. in coal, iron, grain, and agricultural produce, Erie is said to ship more fresh-water fish than any other



Erie. Port Colborne, Ontario, on Lake Erie. The lake, which forms part of the boundary between Canada and the U.S.A., is connected by the Welland Canal with Lake Ontario. It is an important shipping waterway

port in the world. It leads in U.S. production of engines and boilers and also makes locomotives, stoves, pumps, furniture, wood-work, leather, and paper. The federal building and city hall are prominent. Founded on the site of the old French fort of Presque Isle, erected 1753, Erie has a city charter dating from 1851. In 1915 the city was inundated by a cloudburst. Pop. (1950) 130,803.

Erie Canal. The largest artificial waterway in the U.S.A. Extending across New York state from Buffalo to Troy, it communicates between the Hudson river and Lake Erie. Begun in 1816 as a pioneer U.S. engineering feat, and completed in 1825, it was originally 363 m. long from Buffalo to Albany. The canal, which made possible the all-water transport of Pennsylvania's coal, iron, and petroleum and the Middle West's agricultural produce to the Atlantic, was responsible for the rise to commercial supremacy of the state and port of New York. Today petroleum products constitute the bulk of goods transported. The canal gives passage to vessels of 2,000-3,000 tons. It is 340 m. long, 150 ft. wide, 12 ft. deep, and has 34 locks. For five months in the year ice obstructs navigation.

Erigena, JOHANNES SCOTUS (c. 810-877). Scottish philosopher and theologian. He was a Scot born in Ireland, at the time called Greater Scotland, and his name Erigena means Irish-born. Summoned by Charles the Bald to Paris, he became teacher at the court school. Erigena attempted to combine the neo-Platonist theory of emanation with the Christian idea of the Trinity, the result being a kind of pantheism, the view that all things are contained in God. *De Divisione Naturae* was his chief work.

Erin. Poetical name for Ireland. It was popularised by Thomas Moore's *Irish Melodies*, but is of much earlier origin. Philologists assume an old Celtic form, *Iveriu* or *piyeriu*, probably meaning fertile (cf. Gr. *pi-ōn*, fat), in old Irish *Eriu*, in the declension of which *Erin*, *Erinn*, appear. The Greek name *Iernē* = *Ivernē*, the *v* being

preserved in the Latin *Juvena* or *Juberna*, of which *Hibernia* (*q.v.*) is another form.

Erin go bragh. Irish phrase meaning Ireland for Ever. Through its association with Ireland's demand for a freer and more independent government it became a party instead of an entirely national cry. It is widely used as an expression of national sentiment.

Erinus. Genus of alpine herbs of the family Scrophulariaceae, natives of W. Europe. The spoon-shaped leaves, which grow in a tuft, have their broad ends boldly cut into about five pointed teeth. The leafy stem ends in a cluster of rosy-purple or white flowers.



Erinus. Roots, foliage, and flower of *Erinus alpinus*

Erinyes. In Greek mythology, older name of the Eumenides (*q.v.*), or tragic furies.

Eriocaulaceae (Gr. *erion*, wool; *kaulos*, stalk). Family of rush-like perennial marsh herbs. Chiefly natives of the tropics, they have slender, spongy leaves, and minute flowers gathered into a head. These flowers are either male or female, the former having two or three stamens and a rudimentary ovary, the latter with developed ovary and short style, but no stamens. Pipe-wort (*Eriocaulon septangulare*), a N. American species, occurs in muddy lakes of W. Ireland.



Eriocaulaceae. 1. Leaf of a species of *Eriocaulon*. 2. Male flower. 3. Entire plant. 4. Head of flower

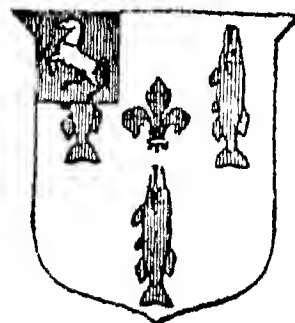
Eriphylē. In Greek legend, sister of Adrastus, king of Argos, and wife of Amphiarus. Before he joined the expedition of the Seven against Thebes, Amphiarus charged his son Alcmaeon to murder his mother as soon as he should hear of his father's death,

and in due course Alcmaeon obeyed his behest.

Eris. In Greek mythology, goddess of discord. Annoyed at not being invited with the other gods to the wedding-feast of Peleus and Thetis, she threw a golden apple into the midst of the feast inscribed "For the fairest." It was claimed by Hera, Athena, and Aphrodite, and the Trojan prince Paris had to judge. Because he chose Aphrodite, she rewarded him with possession of Helen of Greece, which led to the Trojan war.

Eriskay. Island in the Hebrides, Scotland, lying S. of South Uist. It is the spot at which Prince Charles Edward landed with seven companions from France, July 23, 1745; according to legend he planted a white convolvulus which will grow nowhere else. The Eriskay Love Lilt is one of the most familiar Hebridean songs.

Erith. Industrial town and borough of Kent, England. It is on the S. bank of the Thames,



Erith arms

14 m. E. of London, and is served by the electrified railway and London Transport. The town is divided into industrial and residential districts; the latter, to the S., consist of Abbey Wood, Belvedere, and Northumberland Heath. The industrial section, with a frontage of 4 m. on the river, does not intrude upon the amenities of the town. Engineering works, cable and plastic manufacture, edible oil refining, chemical works, coal shipping, lighterage, building materials, stoneware, and asbestos works provide employment. The church of S. John the Baptist has some interesting brasses; parts of it date from the 12th and 13th centuries. The Royal Alfred Seamen's Home for disabled seamen is in the town. In the Middle Ages Erith was famed for its ship-building, and the first man-of-war was built here. A borough charter was granted in 1938. It suffered damage from the Luftwaffe during the Second Great War. Pop. (1951) 46,263.

Eritrea. Autonomous region of East Africa, a federal division of Abyssinia from 1952. It is a coastal strip of coral formation on the Red Sea, running about 670 m. between the Anglo-Egyptian Sudan and French Somaliland. The coast, with a tropical climate,

is often excessively hot and moist, but the uplands are cool. Rain is adequate for agriculture; pasture abounds. Products include hides, ostrich feathers, salt, gold. Pearl fishing is carried on at Massawa. Rly. and good roads connect the principal towns; Asmara (pop. 117,000) is the capital. The inhabitants, who speak Tigré or Tigrenga, include Christians and Muslims. Area 15,754 sq. m. Pop. est. 1,103,000, partly nomadic.

The Italians bought Assab in 1870 from the local sultan for £1,880, made it a colony in 1882, then began to spread, occupying Massawa in 1885 and, with surrounding territory, forming the

definitely ceded to Russia by the treaty of Turkmanshai, 1828. It became chief town of a government in Transcaucasia, and in 1918 centre of an Armenian republic. Here are an Armenian university and national museum. Pop. 200,000.

Erlangen. Town of Bavaria, Germany. It is in Franconia, 15 m. N.N.W. of Nuremberg, just where the Schwabach joins the Regnitz. Its chief buildings are the town hall and the university (1743, a former palace), and there are a number of churches, schools, etc., but none is notable architecturally. Industries concern electric instruments, beer, paper, and textile goods, the last, to which the

1906. A ballet, *Les Cent Baisers*, was one of the most successful productions of the de Basil company's seasons at Covent Garden, 1935-36. A symphonic suite and a violin concerto gained reputation.

Erlanger, JOSEPH (b. 1874). American physiologist. He was born Jan. 5, 1874, at San Francisco, and studied at the universities of California and Johns Hopkins. At Johns Hopkins hospital, 1899-1900, he became instructor, assistant, and associate professor at the university, 1900-1906. He was professor at Wisconsin university 1906-10, and at Washington university, St. Louis, 1910-46. A member of the National Research Council, 1922-26, and of many learned societies, he was awarded the Nobel prize for physiology and medicine in 1944. Erlanger wrote (with H. S. Gasser) *Electrical Signs of Nervous Activity*, 1937; *Symposium on the Synapse*, 1939.

Erlau. German name of the Hungarian city of Eger. The red wine produced in the area was long called Erlauer. See Eger.

Erl-king OR ERLKÖNIG. Figure in German mythology. He personifies an evil spirit haunting forests and plotting mischief to passers-by, especially children. The word, meaning king of the alders (Ger. *Erle*), from the vapours that cling to these trees at night, is a mistranslation, and should properly be elf-king, its meaning in Scandinavian (Dan. *Ellerkonge*). The character was introduced to German folklore by Herder's translation of the Danish ballad, *Sir Olaf and the Erl-king's Daughter*, 1778-79. It is the subject of a famous ballad by Goethe, set to music by Schubert.

Ermeland. A level, sandy region, stretching inland from the Frisches Haff (Zalew Wislany) between Elbing (Elblag) and Königsberg (Kaliningrad), area 1,700 sq. m. The name was borne by a district in Prussia before that country passed into the possession of the Teutonic Order. It was later the principality of a bishop, and was a member of the Holy Roman Empire. In 1466 it was added to Poland, but at the partition of Poland in 1772 it was seized by Prussia. It includes Allenstein (Pol. Olsztyn), once a seat of the order of Teutonic knights. The line dividing the part of E. Prussia incorporated in the R.S.F.S.R. and the part incorporated in Poland by the Polish-U.S.S.R. treaty of Aug., 1945, runs through the district. Pop. (pre-war) 270,000, the majority R.C. and Polish.



Erith, Kent. A view of the High Street of this borough on the south bank of the Thames. See text in facing page.

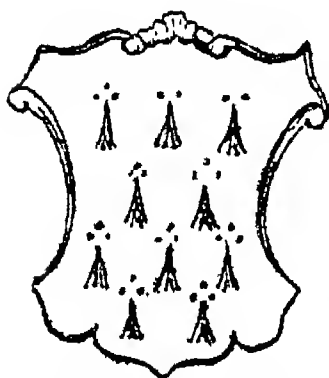
colony of Eritrea in 1889. Italian enterprise was checked after a disastrous defeat by Abyssinian forces at Adowa, March 1, 1896. By an Act of 1936 the territory became a state of Italian East Africa. For the Second Great War in Eritrea, see East Africa Campaign. At the conclusion of the fighting, the country came under a British military administration which carried out improvements in agriculture and forestry, education and justice. In 1942 Eritrea was developed as a U.S. base. Consult *Short History of Eritrea*, S. H. Longrigg, 1945.

Erivan. Capital of Armenia S.S.R. It stands on the Sanga, near the Turkish border, 40 m. N.E. of Ararat and 145 m. S. of Tbilisi. It is the seat of a bishopric and contains the remains of an old palace of the Persian viceroys. An active trade is carried on in leather, pottery, and cotton. After being alterhately in the hands of Turks and Persians, Erivan was taken by the Russians in 1827, and

town owes much of its prosperity, having been introduced by immigrant Huguenots. The university was founded by Frederick, margrave of Bayreuth; it has a large library, botanical garden, and hospital, in addition to laboratories, etc. Erlangen passed in the Middle Ages from one ruler to another. It was made a town in 1398, and until 1791 was in the margravate of Bayreuth; then it passed to Prussia and in 1810 to Bavaria. Pop. (est.) 35,000.

Erlanger, BARON FRÉDÉRIC D' (1868-1943). French-born British composer. He was born in Paris, May 29, 1868, and studied music under Ehmant. In 1891 he became a naturalised British subject, joining his brother Émile in a firm of financiers. He died April 23, 1943. As a composer he was influenced by Bizet and Chabrier, and his compositions included operas, orchestral pieces, songs, and chamber music. The best-known operas were *Inez Mendo*, 1897, and *Tess of the d'Urbervilles*,

Ermine. Name given to the winter phase of the stoat, when the fur is white with the exception of the black tip of the tail. In Great Britain this change from the brown of summer takes place regularly in Scotland, and often in the N. of England; but further S. it is very rare. The ermine fur of commerce comes from more northern latitudes, chiefly from Alaska; but it is now in little favour, except for official robes. The name is a corruption of Lat. *Armenius* (*mus*), i.e. Armenian (mouse), or of Ger. *Hermelin*, ermine, ermine-fur. (See Stoat.)



Ermine in heraldry is the principal fur. It is represented as silver or white powdered with sable spots, usually depicted like a small arrow head surmounted by three dots. There are four variants: ermines represented as black powdered with silver spots; erminetes or erminites, represented as black with silver spots between two red hairs; erminois, black with gold spots, and pean, gold with black spots.

Ermine Street. Early English name for the ancient Roman highway from London to Lincoln and York (via Royston, Godmanchester, Castor, and Ancaster), later called the Old North Road. With Watling Street, the Icknield Way, and Fosse Way, it was one of the four royal roads of Edward the Confessor's laws. The name Ermine Street is also used for the Roman road from Silchester to Cirencester and Gloucester.

Ernakulam. Coast town of Kerala, India, 100 m. S.S.E. of Calicut. Formerly the capital of the princely state of Cochin, it is the seat of several colleges, including a college of law. Pop. (1951) 62,283.

Erne OR SEA EAGLE (A.S. *earn*, eagle). The white-tailed sea eagle (*Haliaeetus albicilla*), the only member of its group still found in Great Britain. It is brown, about 3 ft. in length. It still breeds in the Hebrides, but is becoming rare.

Erne. River of north-western Ireland. It issues from Lough Gownagh, in co. Longford, and flows mainly N. through Lough Oughter and both upper and lower Lough Erne until it falls into Donegal Bay near Ballyshannon. Its length is 70 m. Enniskillen is the chief town on its banks, and after leaving Longford it passes

through counties Cavan and Fermanagh. The hydro-electric scheme utilising the falls of the lower Erne in and above Ballyshannon (*q.v.*) supplements the Shannon scheme. Erne salmon fishing, except in the estuary, must suffer.

Erne. Name of two loughs or lakes of co. Fermanagh, N. Ireland. The upper lake is 13 m. long, and in one place 4 m. wide; the lower lake is 18 m. long, and from 2 to 5 m. broad. The river Erne passes through them, the distance between the two being 10 m. The lakes occupy hollows in the limestone, and have a very irregular shape; the upper portion is merely a collection of narrow ponds abutting on the river. In both, but especially in the upper lake, are numerous islands.

Ernest. Masculine Christian name, probably derived from the German *ernst*, serious. The French form is Ernest; Ital. and Span. Ernesto. Its introduction into Britain dates from the 18th century: the fifth son of George III was Ernest Augustus (*v.i.*). The feminine form is Ernestine.

Ernest Augustus (1771-1851). King of Hanover. The fifth son of George III of England, he was born at Kew, June 5, 1771. He entered the Hanoverian army and distinguished himself during the Napoleonic wars. In 1799 he was made duke of Cumberland and Teviotdale, and in the house of lords he acted with the more extreme Tories in opposing all kinds of reform, especially Roman Catholic emancipation and the reform measure of 1832. In 1810 some excitement was caused by a murderous attack made on the duke by his valet; the latter was afterwards found dead, and some went so far as to accuse Ernest of his murder.

Until the birth of a daughter, Victoria, to his elder brother Edward, he was heir presumptive to the English throne. By the operation of the Salic law he (and not Victoria) succeeded to the throne of Hanover in 1837. There he reigned for fourteen years. He would not hear of anything in the nature of constitutional reform, but in spite of this he was popular with his subjects. He died Nov. 18, 1851, and was succeeded by his son George (1819-78), who supported Austria in the war of 1866 and was deposed by Prussia which annexed Hanover.

Ernle, ROWLAND EDMUND PROTHERO, BARON (1852-1937). British politician and writer. Born Sept. 6, 1852, at Clifton-on-Teme, he was educated at Marlborough

and Balliol College, Oxford, becoming fellow of All Souls. He was admitted to the bar, and in 1894 was editor of *The Quarterly Review*. An authority on agriculture, he was appointed agent-in-chief to the duke of Bedford in 1899. In 1914 Oxford University chose Prothero as one of its members, and in 1916 he was included in the Coalition government as president of the board of Agriculture. He continued in office after the general election of 1918, and was made a peer. He wrote *The Pioneers and Progress of English Farming*, 1888; *English Farming, Past and Present*, 1912; but his most popular works are *Life and Correspondence of Dean Stanley*, 1893 (with G. G. Bradley); *The Psalms in Human Life*, 1903; *The Land and Its People*, 1925. He died July 1, 1937.

Ernst, MAX (b. 1891). German painter. Prominent among the early surrealists, he was one of the leaders of the movement. He worked in Paris during the 1920s, and was among the first of the group, which included Dali (*q.v.*), Tanguy, and Masson, to abandon abstract form for recognizable imagery. His work was banned by the Nazis in Germany. His book illustrations, executed for the *Éditions du Carrefour* in 1930, were among his popular works.

Ernulf OR **ARNULF** (1040-1124). English ecclesiastic. He was born in France and educated at Bec, under Lanfranc. Made prior of Canterbury by Anselm, he was abbot of Peterborough from 1107 to 1114, when he became bishop of Rochester. He was a great authority on canon law, and the author of the *Textus Roffensis*, preserved in the library of Rochester Cathedral, which comprises records of the cathedral, and other historical ecclesiastical, and legal documents. This collection contains the form of excommunication entitled *The Pope's Dreadful Curse*, quoted by Sterne in *Tristram Shandy* to show his veneration for the pious bishop who had ready for use "fit forms of swearing suitable to all cases."

Erode. Town of Madras, India. It is in the Coimbatore district, and was at one time a place of some importance. It suffered during successive invasions of the country in the 17th and 18th centuries. The town, which is the headquarters of the divisional officer, contains two old temples. Pop. 35,000, five-sixths Hindus.

Eroica. Popular name of the symphony No. 3 in E flat by Beethoven (op. 55). Completed in

Aug., 1804, it was intended originally as a tribute to Napoleon, but Beethoven's later revulsion against the conqueror caused him to modify the sub-title to "In memory of a great man," and Prince Lobkowitz received the dedication. The magnificent sweep of the first movement, and the profound, sombre slow movement have caused this work to be acclaimed among Beethoven's greatest.

Eros (Gr., love). In mythology, the Greek name for Cupid (*q.v.*). It is also the popular name for the aluminium figure surmounting the memorial, in Piccadilly Circus, London, to the 7th earl of Shaftesbury (*q.v.*) designed by Alfred Gilbert. This winged statue, 9 ft. high, was unveiled in 1893. During the reconstruction of the tube rly. station under Piccadilly Circus, 1925-28, it was placed in the Embankment Gardens, and it was again removed from its site during the Second Great War, being replaced June, 1947. The sculptor intended the figure to symbolise the Christian virtue of charity.

Eros. One of the nearer minor planets, discovered in 1898. The importance of the asteroid is that it can approach within 14,000,000 m. of the earth. At such times observations of its distance can be made accurately, and thence, its orbit being known, the mean distance of the sun from the earth can be found, this quantity being the fundamental unit of distance used by astronomers (*see* Astronomical Unit). In 1930-31 Eros came within 16,200,000 m. and international cooperation made available nearly 3,000 photographs taken with 30 telescopes in 14 different countries. Sir Harold Spencer Jones in 1941 arrived at the value 93,003,000 m. for the sun's distance.

Erosion (Lat. *erosio*, eating away). The wearing down of the earth's surface through the action of the atmosphere, rain, rivers, ice, and the sea and its tides. Atmospheric erosion is either chemical or mechanical. Wind transports particles and polishes surfaces over which they are carried, *e.g.* in deserts. Sudden changes of temperature cause particles of rock to split off, subsequently to be removed by wind or water. Atmosphere acts chemically through rainfall, in causing decomposition of rocks. Disintegration of rocks being thus effected, the products are afterwards removed by running water, the water usually eroding the boundaries of its course by abrasive action of materials carried.

Erosion beneath the surface of the ground is chiefly chemical, and often results in formation of caves and caverns, especially in limestone districts. Glacial erosion takes place over large areas and on an extensive scale, ice being, under certain conditions, a powerful scouring agent. Marine erosion is in continuous progress along coasts, the sea often using debris broken from cliffs by waves as battering-rams for further destruction. The burrowing of animals, *e.g.* worms, and penetration of roots of plants assist also in disintegration of land surfaces. The tendency of all erosion is to level the land. *See* Coast; Glacier; Soil Erosion.

Erosion. Term used in metallurgy. Metal articles can be fabricated by first grinding the metal to a powder, pressing into shape in suitable moulds, and then baking. The pulverisation is sometimes referred to as erosion. The term is also used to describe effects which lead to corrosion of metals normally protected by surface films. These effects are due to the breakdown of cavities beneath the protective layer, leaving the metal exposed to corrosive agents.

Erotic Literature (Gr. *erōtikos*, amatory). Literature inspired by the theme of love. The name is generally applied to poetry, and latterly more especially to poetry of a warmly impassioned character. The classical erotic poets include Anacreon, Callimachus, Sappho, and Theocritus among the Greeks; Catullus, Horace, Ovid, and Tibullus among the Latins. The troubadours of the Middle Ages carried on the erotic tradition in France, and at the Renaissance this form of literature had a revival on the continent of Europe. In English literature it reached a high level in the lyrical work of poets of the 17th century, such as Donne, Cowley, Herrick, Waller, Lovelace, and Suckling. In the 19th century, more especially in the latter half, it had a recrudescence in the poems of Rossetti and Swinburne, and in France in the writings of Baudelaire and others.

Er Ram. Village of Palestine. It is situated on a hill on the Jerusalem-Nablus road. Identified as the ancient Ramah (*q.v.*) of Benjamin (1 Kings 15), it formed a kind of frontier castle between the N. and S. kingdoms of Palestine, and was repopled after the return from captivity. It was taken by Allenby, Dec. 28, 1917, in the British advance after the capture of Jerusalem in the First Great War.

Erratics (Lat. *errare*, to wander). In geology, portions of rock of varying size which have been moved from their original home by natural agencies. They commonly consist of rock-fragments torn away by glaciers, and often bear scratches resulting from movement under great pressure. They occur in great profusion in glacial boulder-clays, and are often spread over high levels by glacial torrents. *See* Glacier; Rock.

Errigal or ARIGAL. Mountain of the Irish Republic, in Donegal. It is 5 m. S.E. of Gweedore and is 2,466 ft. high.

Erroll, EARL OF. Scottish title borne since 1452 by the family of Hay. William Hay, hereditary constable of Scotland, an honour given in 1315 to his forefather, Sir Gilbert, was made an earl in 1452. Francis, 9th earl, was active in the 16th century, being constantly in rebellion against James VI. He was then a Roman Catholic, and in league with Spain; in 1594 he led a small rising, after which his residence, Slains Castle, was destroyed. Later he became a Protestant.

A dispute as to whether Erroll or the earl marischal was the rightful constable was decided in favour of the former, and so the earls take precedence in Scotland just after the royal family. When the 13th earl died unmarried his sister succeeded to the title. The great-nephew who followed was a son of the earl of Kilmarnock who was executed for his share in the rising of 1745, but this did not affect his succession to the earldom of Erroll, and from him the later earls are descended. The 18th earl was made a peer of the U.K. as Baron Kilmarnock in 1831. Diana Denyse Hay (b. 1926) succeeded her father, the 22nd earl, in the earldom in 1941; the barony went to her uncle Gilbert (b. 1903).

Erromanga. One of the S. group of the New Hebrides. It measures 30 m. long by 20 wide. The chief anchorage is Dillon's Bay; the chief product, copra. Here John Williams, the missionary, was killed and eaten by cannibals in 1839.

Error. False idea which is regarded as true; or the degree or extent to which a statement deviates from the actual. An example of the former is the belief, held for many centuries, that the sun revolves round the earth. An example of the latter is the statement that the population of England and Wales in 1931 was 40,000,000 to the nearest million,

the error in this figure being not more than plus or minus half a million. The word is used in the second sense particularly by scientists, statisticians, engineers, etc.

An error of the other type, commonly called a fallacy, is caused by an appearance of truth which is deceptive. Such an error may arise through faulty definition, misunderstanding, or wrong use of words, ambiguous statements, bad deduction, faulty observation, incorrect generalisation, confusion of cause and effect. Human history abounds in notable fallacies. Many of them are systematically dealt with in such books as Jevons's *Elementary Lessons in Logic*, Mill's *Logic*, Welton's *Manual of Logic and Groundwork of Logic*.

The advance of natural science has corrected many faulty observations and vastly improved our power to observe, and thus has tended to lessen the number of material errors; but little progress has been made towards the elimination of formal errors, *i.e.* those violating the rules of good reasoning. Terms are still used without adequate definition; we still "argue from the particular to the general," and "beg the question," mistake cause and effect, and presume where we cannot prove. We are prone to the fallacy of epithets: we believe we have proved our judgement of a person or act or thing when we have chosen a particularly strong adjective to describe it.

ERROR IN APPROXIMATION. In a statement such as 65,000 tons *to the nearest thousand*, or 0.036 inch *to the nearest thousandth*, the degree of approximation is stated. In the former we are told that the actual weight lies between 65,000—500 tons and 65,000+500 tons (the statement might be written $65,000 \pm 500$ tons); in other words, the true weight lies between 64,500 and 65,500 tons. In the second statement we are told that the true length is 0.036 ± 0.0005 inch, *i.e.* it lies between 0.0355 and 0.0365 inch. The amount of error that is allowable in a statement depends on the circumstances. Thus, if we are considering the profit of a company which last year made £1,465,594 16s. 11d., it would probably suffice if we knew that the profit was £1.5 million to the nearest half-million pounds; if, on the other hand, we were considering the cost of generating electricity, say 0.1374d. a unit, we might be interested in the nearest ten-thousandth of a penny. The cook might weigh to the nearest

ounce; the research chemist to the hundred-thousandth part of a gramme.

The amount by which the statement of a quantity differs from the true quantity is called the *absolute error*. Thus, the absolute error in the statement of the company's profit as £1.5 millions was £34,405 3s. 1d. Generally the absolute error of an approximation is not more than half the unit of approximation.

Error, WRIT OF. Name of a writ of appeal to the king's bench in criminal cases, or to the court of exchequer chamber or the house of lords in civil cases. It was for errors appearing on the record, but it is now abolished in all cases.

Ersatz (Ger., equivalent, substitution). Term used in Germany to denote artificial substitutes for natural materials. The word came into use in the First Great War, when it was originally applied to coffee made from acorns and to sugar extracted from wood. During the Second Great War, the greater part of German commodities of everyday consumption, *e.g.* food, clothing, utensils, etc., were of ersatz materials or had an ersatz basis. Ersatz or substitute materials have been developed all over the industrial world and may be said to include plastics, buna, and rayon. See *Synthetic Chemistry*.

Ersch, JOHANN SAMUEL (1766–1828). German bibliographer. He was born at Grossglogau, Silesia, June 23, 1766, and studied at Halle. He was successively librarian, 1800, and professor, 1803, at Jena, and principal librarian, 1808, at Halle. His *Handbuch der deutschen Literatur seit der Mitte des 18ten Jahrhunderts*, 1812–14, laid the foundation of German bibliography. In 1818 he began, with J. G. Gruber, the famous *Allgemeine Encyclopädie der Wissenschaften und Künste*, which was not completed a century later. He died at Halle, Jan. 16, 1828.

Erskine, THOMAS ERSKINE, 1ST BARON (1750–1823). British lawyer. The youngest son of the 10th earl of Buchan, he was born in Edinburgh Jan. 10, 1750 (N.S.). After a scanty education at Edinburgh and St. Andrews, he abandoned careers in both navy and army, his poverty making it impossible for him to buy advancement; and decided to try the law. In 1776 he matriculated at Cambridge, received an honorary degree there in 1778, and the same year was called to the English bar. Erskine's success as a barrister was instantaneous. He made

his name in his first case, an action for libel brought by Lord Sandwich and others against one



1st Baron Erskine,
British lawyer
After Hoppner

Thomas Baillie who had accused them of corruption in the management of Greenwich Hospital. By his fierce attack on Lord Sandwich, Erskine, most junior of five defending counsel, won the case for Baillie. In 1781 he was junior counsel for Lord George Gordon at his trial for treason.

In 1783 Erskine took silk, then a rare distinction; and in the same year was elected M.P. for Portsmouth. After six years' absence he was again returned for that borough in 1790.

Erskine defended Paine, Tooke, and others who wrote in favour of the French Revolution. Having been attorney general 1783–92 and chancellor 1802–06 to the prince of Wales, he was lord chancellor in the Whig ministry of 1806–07. He was made a peer in 1806. He spoke strongly in support of Queen Caroline during her trial in 1820. He died in West Lothian, Nov. 17, 1823.

Erskine's eldest brother, Henry (1746–1817), was also a distinguished advocate. Trained at St. Andrews and Edinburgh for the Scottish bar, he was lord advocate in 1783, and again in 1806–07. He died Oct. 8, 1817. Like his brother's, his reputation rests upon his stately and pleasing eloquence.

Erskine, EBENEZER (1680–1754). Scottish divine and founder of the Secession Church. Born at Dryburgh,

Berwickshire, June 22, 1680, he was educated at Edinburgh University. His first charge was at Portmouk, Kinross-shire, whence he moved to a



Ebenezer Erskine,
Scottish divine

church at Stirling. There he came into collision with his ecclesiastical superiors, and the matter came to a head when, in 1732, he declared that parishes should choose their own ministers. This led to his suspension, but with some associates he founded a separate presbytery, which developed into the Secession Church.

In this Erskine remained until 1748, when the section opposed to him secured his removal from the ministry. He died at Stirling, June 2, 1754. His Life and Diary appeared in 1840. See Presbyterianism; Secession Church.

Erskine, JOHN, OF DUN (1509-91). Scottish reformer. He was educated at King's College, Aberdeen, travelled on the Continent, and in 1534 returned with a French scholar, who introduced the study of Greek into Scotland. His enthusiasm was equally divided between the new learning and the new faith. He was an intimate friend of John Knox, and his influence was always exerted in the direction of moderation. He was moderator of the general assembly and in 1579 was appointed a member of the king's council.

Erskine May. Popular name for A Treatise on the Law, Privileges, Proceedings, and Uses of Parliament, by T. Erskine May (Lord Farnborough), first pub. 1844 (15th edn., 1950). This work is accepted in the British house of commons as the authority on the rules and precedents of parliamentary proceedings.

Eruptive Rocks. Rocks which have been either extruded at the surface of the earth or have consolidated beneath the surface under pressure of overlying rock-masses. Those extruded (effusive rocks), as in volcanic eruptions are of the type of lava and are found near volcanoes, active or extinct; they frequently exhibit flow-structure, indicating rapid consolidation. Basalts and rhyolites are examples.

Rocks consolidated beneath the surface (intrusive rocks) are of two kinds: very deep-seated (plutonic) and less deep-seated (hypabyssal). Plutonic rocks are usually coarsely crystalline, never glassy or with vapour cavities; hypabyssal rocks are often coarsely crystalline, but show great variation in structure. Intrusive rocks occur as areas of great extent and irregular shape (batholiths), as spreading sheets forced up from below between other strata (laccoliths and sills), as filling the pipes of old volcanoes (necks), as occupying more or less vertical fissures (dykes), or as branching injections (veins).

Ervine, ST. JOHN GREER (b. 1883). Northern Irish dramatist and dramatic critic. Born at Belfast, Dec. 28, 1883, he had his first play, Mixed Marriage, produced in 1911, at the Abbey Theatre, Dublin (of which he was manager in 1915). Other successful

plays included Jane Clegg, 1913; The First Mrs. Fraser, 1929; Robert's Wife, 1937. He wrote also novels; studies of Carson, Parnell, Wilde, and others; and books on theatre craft. He was for many years dramatic critic to the Morning Post and the Observer.

Erymanthus (mod. Olonos). Mountain of Arcadia, ancient Greece. The loftiest peak in the Kalliphonia range, it is associated with the story of Hercules and the Erymanthian boar which haunted this region and was slain by the hero. Alt. 7,296 ft.

Erysipelas (Gr. *erythros*, red; *pella*, skin). Acute contagious disease due to infection by the micro-organism *Streptococcus pyogenes*. Infection occurs through some injury to the surface of the skin, which may be quite trivial, such as a cut while shaving. It was formerly believed that the disease could arise without a wound, the so-called "idiopathic" form, but it is now recognized that in every case there is some lesion, however small. The skin rapidly becomes swollen and red, the inflammation advancing with a more or less well-defined margin and dying away behind this. The face is most frequently involved, and the swelling may cause the eyes to close. The temperature rises to 103° F. or more, and delirium may occur.

The duration of the disease is variable, but generally it lasts from one to three weeks. Death in healthy adults is rare, but in aged, debilitated persons and chronic alcoholics the outlook is not so good. Recently delivered women exhibit an increased liability to the disease. Treatment is by the sulphonamide and streptomycide group of drugs and by the use of antistreptococcal serum. Ichthyol has been found to be a useful local application, and belladonna or opium may be used to relieve pain. The patient must be isolated.

Erythema (Gr. from *erythainein*, to make red). Redness of the skin owing to dilation of the small blood-vessels. The condition may be localised, when it may be due to simple inflammation, burning, or irritation by chemical substances, or it may be more or less present over the whole body, when it is usually a symptom of infectious fever, e.g. scarlet fever or measles; or of poisoning by unsound food or certain drugs, particularly belladonna; or is a manifestation of disease of the skin.

Erythrite (Gr. *erythros*, red). Sweet-tasting carbohydrate alcohol known under various synonyms

e.g. erythritol, erythrol, erythroglucin, erythromannite, lichen sugar, phycite, tetrahydroxybutane. First prepared by Stenhouse in 1848 from several species of lichen such as orchella weed (*Roccella tinctoria*), it occurs in the free state or combined with orsellinic acid, or may be made synthetically. It crystallises in large transparent prisms, with a melting point of 126° C.

Erythrite OR COBALT BLOOM. A cobalt mineral, hydrous cobalt arsenate, $\text{Co}_3\text{As}_2\text{O}_8 \cdot 8\text{H}_2\text{O}$, peach-red in colour and occurring in monoclinic prismatic crystals, often in globular or earthy incrustations. It is of secondary origin.

Eryx. Ancient name of a mountain of Sicily near Trapani (Drepanum), 2,465 ft. high. It was crowned by a famous temple of Aphrodite, called locally Erycina. The temple derived its revenue from 17 Sicilian towns belonging to it. On the western slope of the mountain lies Erice, built on the ancient town of Eryx. Population (1951) 26,268. The Roman walls of the ancient town exist beside the ruins of the temple. Both town and mountain were long called Monte San Giuliano.

Erzberger, MATTHIAS (1875-1921). German politician. Born at Buttenhausen, Sept. 20, 1875, and educated at Freiburg, he devoted himself to the study of political economy. Interested in the Christian Socialist movement, in 1897 he was a delegate at the international conference at Zürich. He entered the Reichstag in 1903, and came into prominence in 1917 when, as a member of the Catholic or Centre party, he made a speech accusing ministers of misrepresenting the military situation, and demanding the reform of the Prussian franchise and a statement of the peace aims of Germany. In 1918 Erzberger was secretary of state when Prince Max of Baden was imperial chancellor, and in 1919 was minister of finance and vice-premier, an honest and far-seeing politician. He resigned in Feb., 1920, and was assassinated on Aug. 26 of the following year.

Erzerum OR ERZURUM. Town of Asiatic Turkey and capital of a vilayet of the same name. It lies in a wide plain at an alt. of 6,250 ft. above sea level, 120 m. S.E. of its port Trabzon, 150 m. W. of Mt. Ararat, and is an important commercial town and military position. It is walled, and its streets are narrow and crooked. It has few fine buildings, the chief being the Armenian and Greek churches.



Erzerum. Mountain city of Turkey-in-Asia, once an important fortress of the Ottoman Empire. To the right is the medieval citadel

Erzerum is the seat of an Armenian bishopric. Leather goods are made. Pop. (1955) vilayet, 521,836; town, 69,499.

Its main importance came from its strategic position. Under the Turks, who occupied it in the 16th century, it was made into a fortress and was the headquarters of an army corps. It was taken by the Russians in 1829 and again in 1878. During the First Great War it was brilliantly captured by the Russians in Feb., 1916, but during the winter of 1917-18 it was abandoned by the Bolshevik government, and was reoccupied by the Turks in March, 1918, in spite of strong resistance by the local Armenians. Erzerum was the scene of massacres of Armenians in 1895 and again in 1915.

Erzgebirge (Czech. Krušné Hory). German name, meaning ore mts., of a frontier mountain range of Central Europe, stretching for about 90 m. from the Elbe to the Elstergebirge. The highest peaks are in the centre, the Keilberg being over 4,000 ft. high. Only a little lower are the Fichtel-

are holiday resorts in the mountains which are visited for both health and pleasure, much of the scenery being very fine. The hills are densely wooded and the district is well served by road and railway.

Erzincan OR ERZINGAN. Town of Asiatic Turkey, capital of a vilayet of the same name. The medieval Arsinga, it lies on the W. Euphrates (Kara Su) 3,900 ft. a.s.l. and about 75 m. W. of Erzerum. Many of its Armenian inhabitants were massacred in 1915. It was taken by the Russians in July, 1916. Silk and cotton are manufactured. Pop. (1955) vilayet. 216,413.

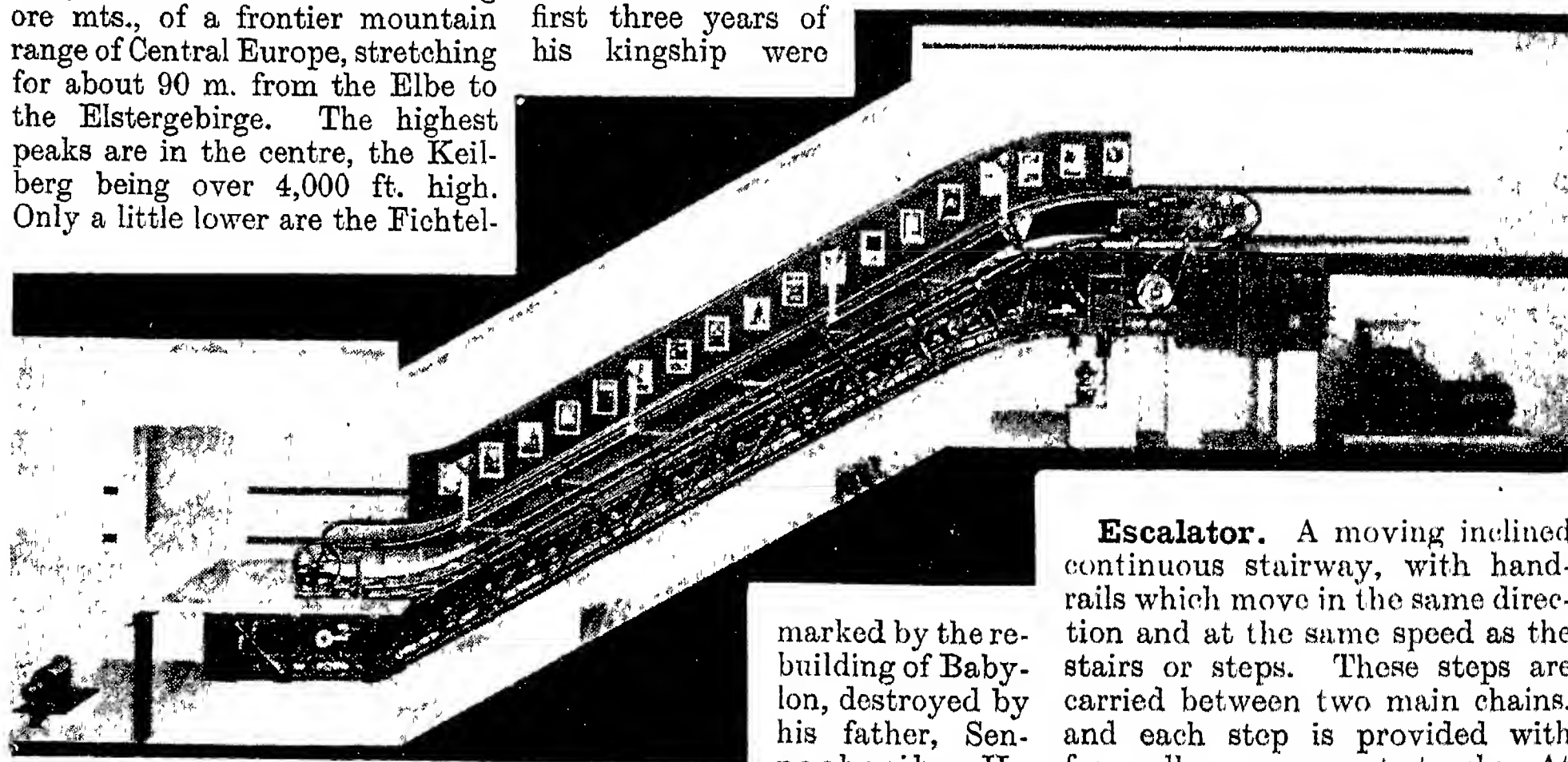
Esarhaddon OR ASHUR-AKH-IDDIN. Assyrian king who reigned 680-669 B.C. Coming to the throne in a civil war, he restored order and maintained it. The first three years of his kingship were

Scythians and Medians. Events of his reign are illustrated on the walls of his palaces at Nineveh and Calah. He died on the way to Egypt to quell a revolt. His son Ashurbanipal succeeded him.

Esau. Son of Isaac and elder brother of Jacob, whose great rival he became after the younger brother had secured by a trick the privileges of primogeniture (Gen. 25 and 27). Esau became a hunting man, married wives of Hittite nationality, and founded a tribe which occupied the mountains S. of the Dead Sea. In his later days he was on friendly terms with Jacob, but his descendants were hated and despised by the Jews.

Esbjerg. Seaport of Denmark. in Ribe co., Jutland. It stands on the North Sea, opposite the island of Fanö, and has regular steamer connexion with Harwich, England. The harbour, built 1868-74, is state-subsidised. Its main exports are bacon, beef, and dairy produce; it has fisheries and some manufacturing industries. Pop. (1950) 48,205.

Escalade (Lat. *scala*, ladder). Medieval method of attacking a fortification. The walls were climbed by scaling ladders or by a staircase or ramp of faggots placed against them.



Escalator. Diagrammatic view of an escalator as used at underground stations and in department stores
By courtesy of Waygood-Otis, Ltd.

berg and the Spitzberg. On the south (Czecho-Slovak) side the range has a precipitous face, but on the N. (German) side it slopes more gradually to the plain. The range, as the name suggests, is rich in minerals, silver, lead, tin, copper, iron, and some gold and uranium being found here. There

of Egypt, planned by Sennacherib, was accomplished in 670 B.C. Revolts in Phoenicia and Cilicia were put down, the turbulent desert Arabs defeated, and Menasseh King of Judah deported. Danger from northern migrants was averted by the defeat of the Cimmerians and alliances with

marked by the rebuilding of Babylon, destroyed by his father, Sennacherib. He greatly extended the Assyrian empire. The conquest

Escalator. A moving inclined continuous stairway, with handrails which move in the same direction and at the same speed as the stairs or steps. These steps are carried between two main chains, and each step is provided with four rollers on separate tracks. At the upper and lower landings the stair formation of the steps on the incline is gradually changed to a flat platform. The tread of each step is provided with a series of cleats, which engage with combs at the upper and lower landings.

Escalators are driven by electric motors through suitable gear reduction units; brakes keep them stationary when not in use. Safety devices stop the escalator

in the event of excessive speed or accidental reversal. Escalators are of particular advantage where large numbers of persons have to be transported between two levels, *e.g.* at underground railway stations or in department stores.

Escallonia. Genus of evergreen shrubs belonging to the family Saxifragaceae, natives of S. America. The



Escallonia. Foliage and flowers of *Escallonia macrantha*

undivided, leathery leaves are covered with resinous glands which render them somewhat sticky. The tubular white, pink, or red flowers are disposed in small clusters at the ends of branches. *E. rubra* and *E. macrantha* are much

grown in the S. of England near the sea as garden hedges. The shrub is named after Escallon, a Spanish traveller.

Escanaba. City of Michigan, U.S.A. The co. seat of Delta co., it is on an arm of Green Bay, Lake Michigan, and lies 116 m. N.N.E. of Green Bay, Wis. It has a rly. station and airport. There are docks for shipping the iron ore of the district, also rly. repair shops. Trade is in fish and charcoal; manufactures include furniture and lumber products. Escanaba was settled in 1846 and made a city in 1883. Pop. (1950) 15,170.

Escape. Play by John Galsworthy. Produced at the Ambassadors' Theatre, London, Aug. 12, 1926, it shows in a prologue and nine "episodes" the reactions of various people encountered by a convict escaping from Dartmoor in the few hours before he is captured. The prologue establishes initial sympathy for the convict, Matt Denant, a part created by Nicholas Hannen. Sir Gerald du Maurier played the part in a film version, 1931.

Escapement. That part of a clock, watch, or chronometer which controls and regulates the motive force, produced by weight or spring, so that correct time may be indicated on the dial. An escapement has two tasks to perform: to allow the teeth of a wheel to escape, or pass a given point, one at a time, so that the motive force is allowed to trickle through in carefully measured and

pre-determined periods of time; and to give impulse to pendulum or balance, so that constant motion will be maintained so long as the motive force continues to operate. Hundreds of escapements have been invented, of which about six have stood the test of time.

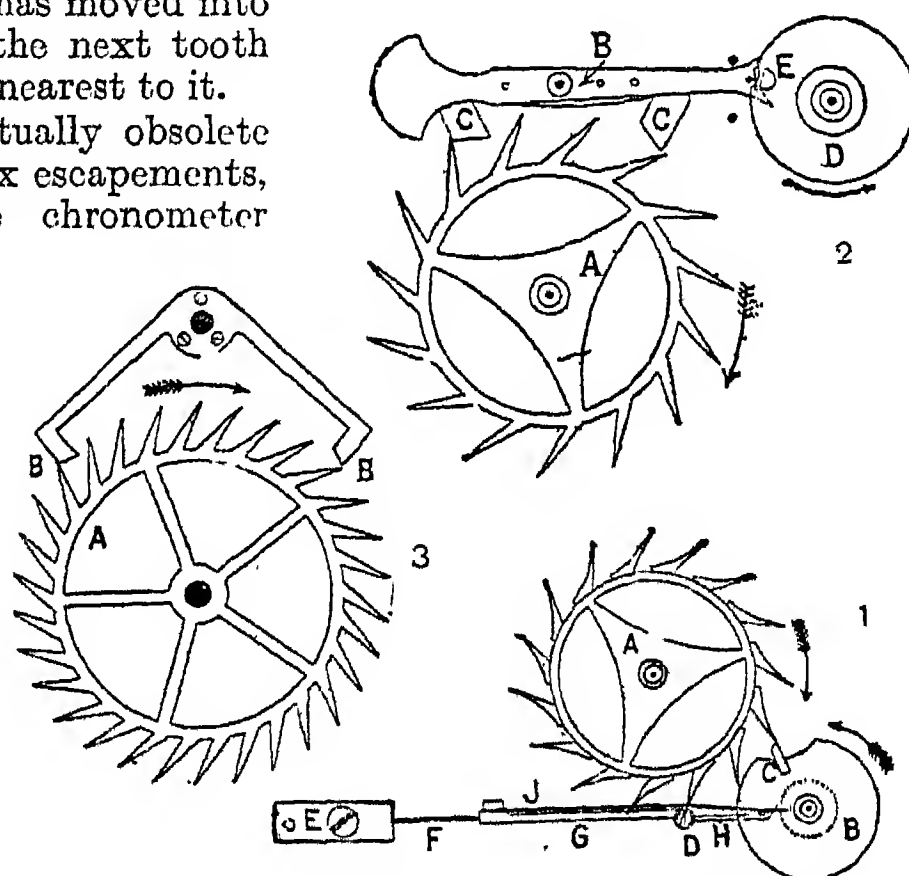
The verge escapement was the first of all but is now quite obsolete. Its inventor is unknown, but it was in use for clocks by the 14th century and continued until the middle of the 17th; for watches 100 years longer. In clocks the escape or crown wheel is mounted on the fastest moving arbor. The verge is a vertical arbor, suspended by a cord from a suitable cock and pivoted at its lower end in a bearing. Two pallets project from the verge at right angles to each other, in line with the teeth at the top and bottom of the crown wheel respectively. Higher up on the verge is a horizontal bar, the balance, with a weight at each end, the moving of which nearer to or farther away from the centre makes the balance swing faster or slower. The action of the escapement is simple. The balance is oscillated in one direction, when one of the pallets, which is holding up the rotation of the crown wheel by engaging one of its teeth, is gradually turned on its axis until the tooth it is holding is allowed to escape. By this time the other pallet, set at right angles to the first, has moved into position to catch the next tooth of the crown wheel nearest to it.

Ignoring the virtually obsolete cylinder and duplex escapements, we come to the chronometer escapement. Invented independently by Arnold and Earnshaw about 1782: the Earnshaw version is the better. The balance is almost entirely "free" from interference by the train, except while receiving impulse on alternate vibrations. The most general use is for marine time-keeping.

The working of three forms of escapement is shown in the diagrams in this page. The chronometer escapement is shown in Fig. 1. A tooth of the escape wheel A is shown at rest on the locking pallet D. B is the impulse roller, E the foot of the detent. The discharging pallet, shown in

dotted lines, comes in contact with a gold spring J, which, in turn, presses on the end of detent H, forcing it back and bending a spring F, so releasing the escape wheel. A tooth falls on the pallet C, the escape wheel communicates an impulse to the balance, and as soon as the pallet has turned sufficiently to allow the escape wheel tooth to drop off, the tooth in front is caught on the locking pallet D, the detent G having meanwhile sprung back into place immediately on being freed from the discharging pallet.

The lever escapement, invented by Thomas Mudge about 1765, is used in almost all good watches today. The balance actuates a lever by means of a roller, which engages in a notch in one end. As the balance swings the roller carries the lever to one side; one of the pallets allows a tooth of the escape wheel to pass, at the same time giving impulse, while the other holds the wheel up again. The lever escapement generally in use is shown in Fig. 2. The escape wheel A has pointed teeth working into two pallets C C, which have pieces of ruby sunk into their working faces. The pallets are fixed to a lever B, which has a notch at one end engaging with a small pin E set into a roller D, on the axis of the balance wheel. In the figure the impulse pin has just entered the notch of the lever and is



Escapement. 1. Chronometer escapement. 2. Lever escapement. 3. Graham's dead-beat escapement. For descriptions see text

about to unlock the pallet. Energy is imparted to the impulse pin by the balance spring. The movements of the lever are kept within their proper limits by means of pins placed in suitable positions.

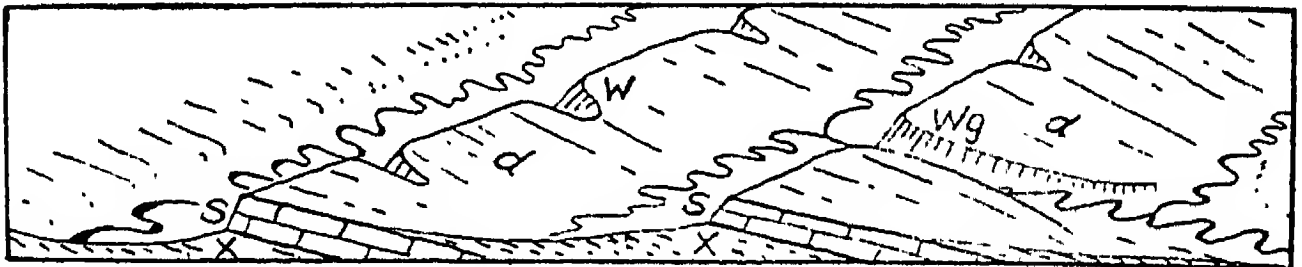
RECOIL ESCAPEMENT. Invented by Dr. Robert Hooke (1635-1703), this is the most important contribution to timekeeping by pendulum clocks. The pendulum was first applied to the verge escapement, which was mounted horizontally instead of vertically, and this gave much more accurate timekeeping, since the swing of the pendulum was more accurate than that of the foliot which it superseded. Hooke realized that timekeeping by pendulum clocks could never be really good unless the pendulum arc could be much less than the 45-50° required with the verge escapement. He accomplished the anchor escapement, the arc of which could be made as small as 1-2°. The anchor escapement is still fitted to moderately priced pendulum clocks.

DEAD BEAT ESCAPEMENT. George Graham (1673-1751) invented this mechanism, which is so fashioned as to allow the escape wheel to drop dead, without recoil, on to the pallet which arrests its further movement. This escapement is expensive and delicate, and is largely used in turret clocks and for regulators. The dead-beat escapement is shown in Fig. 3. A is the escape wheel, B B the pallets. (See page 3135.)

GRAVITY ESCAPEMENT. For large public clocks this is now generally employed. With the recoil and dead beat escapements additional weight can cause erratic timekeeping, and when a number of pairs of heavy hands have to be driven, considerable weight is necessary. Wind also can have a serious effect on the hands. In 1854 Sir Edmund Denison (later Lord Grimthorpe) applied "double three-legged escapement" to the clock familiarly known as Big Ben. The principle of the gravity escapement is that the pendulum in its swing unlocks the pallets, while the weight or motive force causes them to be lifted so as to impart impulse. The escape wheel comprises two three-toothed wheels mounted in different planes, while the pallets are two gravity arms mounted above the escape wheel and having studs on their lower ends which bear on the pendulum. Each gravity arm has a projection which engages one of three pins between the double escape wheel, and after one of the pallets has followed the pendulum to its zero point, thus by its weight giving impulse, it is lifted by the motive force turning the escape wheel, and by the pin engaging the projection

on the gravity arm. When the pendulum swings on its return journey it lifts this gravity arm still farther, thus unlocking the escapement, while the other gravity arm is then lifted. The amount of power on the train has no relation to the impulse, which remains as constant as possible.

Escarpment. In geology, an asymmetrical ridge formed by gently dipping hard beds which lie between softer strata. The less resistant material is eroded away and the hard rock is left projecting. The precipitous edge of the hard beds is called the scarp-face (ss). The gently inclined surface



Escarpment. Diagram illustrating the formation of two escarpments. The lettering is explained in the text

which owes its inclination to the dip of the top of the beds is the dip-slope (*dd*). Valleys or gorges occupied by rivers which cut through escarpments are referred to as water-gaps (*Wg*). Marked notches in the ridge through which past streams, now diverted, may once have flowed are wind-gaps (*W*). With increase in the dip of the beds the dip-slope becomes steeper until it equals the inclination of the scarp-face; the symmetrical ridge so formed is a hog's back. Extensive uplands of escarpment form are known as *cuestas*. Interbedded soft strata are marked *X* on the diagram. The steep edges of flat tablelands are sometimes referred to as escarpments. Examples in England are the Cotswold Hills overlooking the Severn; Wenlock Edge; the N. and S. Downs; and the Chilterns. Escarpment-like ridges may be formed by faulting, as in New Zealand and Western U.S.A., where parallel faults have broken the rocks into elongated blocks which have been tilted. Each block is thus bounded by a steep fault-scarp face and a gentle rear- or dip-slope. Mountains formed this way are usually termed block-mountains. See Fault.

Escaut Line. Defence line of the Second Great War hastily established on the W. bank of the river Escaut or Scheldt (*q.v.*), following the German breakthrough at Maastricht in May, 1940. With its right flank on Ghent and its left on Tournai, the

line was held by the British and Belgian armies from May 11 until May 23, when the German capture of Abbeville so disrupted Allied communications that the line was abandoned and the B.E.F. fell back on the Lys. See British Expeditionary Force.

Eschatology (Gr. *eschatos*, last; *logos*, discourse). Term used for that branch of theology which deals with the four last things: death, judgement, the life after death, and the return of Christ to the earth. All ancient religions and some philosophies paid considerable attention to such a doctrine, the teaching of the ancient Egypt-

tians on life after death being especially detailed. The Bible contains little on the subject. The earlier books of the O.T. appear to take for granted that personality will survive death, and gradually unfold the idea of rewards and punishments after death. The teaching of Christ and His apostles emphasised these truths, but added little to our knowledge. Such passages as the parable of the rich man and Lazarus and the descriptions in the book of Revelation are couched in the language of Oriental imagery, and were not intended to be taken literally.

The general teaching of the Christian Church on the subject has been marked by great reserve, with the exception of the Church of Rome in the Middle Ages, when the doctrine of purgatory was developed in detail. The present attitude of theologians is one of opposition to speculation on the subject. See Immortality; Survival.

Escheat (Lat. *excidere*, to fall out). Term used in law for the reversion of land to its ultimate owner because there is no other heir. It is a relic of feudal times when land was granted by the king or other lord on the condition that in certain contingencies it escheated or came back to him. Land also escheated when the holder was attainted, the theory being that his blood being thus corrupt, his heirs could not inherit. This, however, was abolished in England in 1870. The majority of escheats fell to the crown. Escheat through failure of heirs was abolished in 1925,

though land like other property may pass to the crown as *bona vacantia* on the death of its owner. See Feudalism.

Eschscholtz Bay. Inlet of Alaska. Arm of Kotzebue Sound, Bering Strait, near the Arctic Circle, its name commemorates J. F. Eschscholtz, Russian naturalist.

Eschscholtzia. Botanical name for the genus containing the perennial herb Californian poppy (*q.v.*).

Eschwege. Town of Germany. It stands on the Werra, 38 m. E.S.E. of Kassel, in the *Land* of North Rhine-Westphalia. The old buildings include a 14th century castle, restored in 1581, and the tower of an 11th century monastery. The industries include weaving and tanning. The town was part of Hesse from 1264 until taken by Prussia after the war of 1866. Pop. 13,700.

Eschweiler. Town of Germany, in North Rhine-Westphalia. It is on the Inde, 8 m. E.N.E. of Aix-la-Chapelle, and stands on a large coalfield. The chief industries were the manufacture of iron, steel, and zinc goods, engineering, brewing, and tanning. Captured by American troops after three days' hard fighting, on Nov. 22, 1944, it was lost again in the Ardennes counter-offensive, to be recaptured by the U.S. 3rd army on Jan. 22, 1945. Pop. pre-war 33,090.

Escobar y Mendoza, ANTONIO (1589-1669). Spanish philosopher. Born at Valladolid, he entered the Society of Jesus and gained fame as a popular preacher. In his *Summula Casuum Conscientiae*, 1627, he formulated the maxim that the end, if pure, always

justifies the means, even when the actions may be immoral or illegal. This statement was satirised by such writers as Pascal, Molière, La Fontaine, and Boileau. In France indeed Escobar's name gave rise to the term *escobarderie* for moral laxity. He died July 4, 1669, at Valladolid.

Escombe, HARRY (1838-99). South African politician. Born July 25, 1838, and educated in London, he emigrated to the Cape in 1859 and joined the commercial staff of the Natal Mercury. In 1872 he was elected to the legislative council of Natal. He fought through the Zulu (1879) and Transvaal (1881) wars, and defended Dinizulu successfully against the charge of rebellion. In 1893 he was made attorney-general and devoted himself to developing the commercial resources of the colony. Elected premier in 1897, he came to London for the queen's diamond jubilee. He died Dec. 27, 1899. His collected speeches appeared 1903.

Escott, THOMAS HAY SWEET (1844-1924). A British author. Born at Taunton, he was educated at Queen's College, Oxford. Lecturer in logic and deputy-professor of classical literature at King's College, London, 1866-73, he edited the *Fortnightly Review*, 1882-86, and was for many years leader writer on the *Standard*. His books include *England: its People, Polity, and Pursuits*, 1870; *Social Transformations of the Victorian Age*, 1897; *The Story of British Diplomacy*, 1908; *Masters of English Journalism*, 1911; *Great Victorians*, 1916; *National and International Links*, 1922. He died June 14, 1924.

Escrow. Deed delivered by the person executing it to some third person on the terms expressed either in writing or by word of mouth that the deed is not to be delivered to the other party to it or become effective unless some condition is fulfilled—*e.g.* that the purchaser of land conveyed by the deed shall have paid the purchase money. A deed cannot be delivered as an escrow to the other party to the deed or to his agent.

Escudo (Port., shield). Silver coin, monetary unit of Portuguese currency since May 22, 1911. Divided into 100 centavos, it replaced the old milreis gold piece. In 1950 the official exchange rate was 80½ escudos to the £1 sterling. There are coins of 10, 5, and 2½ escudos. The shield with the national arms is on the obverse. In Spain, a silver escudo, equal to 10 reals, was used 1864-68.

Escuintla. City of Guatemala, 50 m. S.E. of Guatemala City and reached by rly. or motor road. In a fertile tropical valley, it produces grain and fruit. At Concepción, 2 m. distant, is an airport. Pop. 47,400.

Escorial (Span. *El Escorial*). Palace and monastery of Spain, situated 31 m. by rly. N.W. of Madrid, on a spur of the Guadarrama mts. It was designed for Philip II of Spain by Juan Bautista de Toledo, the first stone being laid April 23, 1563. His pupil, Juan de Herrera, carried on the work, which was completed Sept. 13, 1584. Philip dedicated the building to S. Lorenzo in commemoration of his victory over the French on that saint's day, Aug. 10, 1557. Intending it to be



Escorial. Spanish palace and monastery, covering nearly 400,000 sq. ft., seen from the north-west. In the centre is the great church, and the palace, college, and convent occupy parts of the surrounding buildings

a retreat in which he could meditate upon his own end, he ordered that the structure should be of the plainest character.

It is built of grey granite, in the severest Doric style. The plan is that of an immense rectangle, with a comparatively small rectangular wing, embodying the Palace of the Infantas, projecting beyond the E. side. The façades are pierced by rows of small rectangular windows, each row marking a storey. At each of the four angles of the main structure is a tower with pyramidal spire; there are two church towers 230 ft. in height, with the great dome of the church crowning the whole. The main entrance, in the centre of the W. front, is severely Doric, in keeping with the façade. The door itself is 20 ft. high by 10 ft. wide; above it is a colossal statue of S. Lorenzo, the work of the sculptor Monegro. The head, hands, and feet of this statue are wrought in white marble, but the rest of the figure is granite. This entrance leads into a vestibule 75 ft. wide, flanked on the right hand by the convent, including library and refectory, and on the left by the college.

The central space is occupied by the church, the plan of which was based on the original one of S. Peter's, Rome. The dome and lantern are carried on four enormous piers, from which spring the arches of the three naves. Below the high altar is the famous Pantheon of the kings and queens of Spain, beginning with Charles V. The decoration of this octagonal chamber, consisting of precious marble linings, dates from 1654. There are 26 sepulchral urns of dark marble. Distributed over the church are paintings by Tintoretto, Titian, El Greco, Zurbaran, and Ribera in the sacristy, and the masterpieces of Coello in the chapels.

On the N. side is the palace, in the N.E. corner of which were the apartments of Philip himself. In the room in which he died was a panel, by opening which the king could look down upon the high altar of the church. Other apartments of the palace were added to and embellished by later monarchs. There are tapestries after Goya and Teniers. Philip II was the founder of the Escorial library. Don Diego de Mendoza, the Inquisition, and Augustin, archbishop of Tarragona, were other donors, the collection being further increased by confiscated libraries, and by the rule that a

copy of every book published in Spain should be presented to it.

The Hermits of S. Jerome were the first tenants of the monastery, which was stormed in 1808 by French troops; only part of the looted treasure being restored at the peace of 1814. In 1885 Augustinians occupied the monastery.

The Escorial was not damaged in any way during the Spanish civil war of 1936-39.

Escutcheon (old Fr. *escuchon*, Lat. *scutum*, shield). In heraldry, term used to describe a shield blazoned with armorial bearings or other insignia. See Shield.

Esdraelon, PLAIN OF. A fertile tract, sometimes called the plain of Jezreel, of great strategic importance in the history of Palestine. It lies between Galilee and Samaria, and is strewn with the mounds of ancient cities. The word Armageddon, the battle ground of nations in the Apocalypse, derives from the fortress Megiddo (*q.v.*) which dominates it. It has been the scene of many battles, from the victory of Thothmes III over a Canaanite coalition c. 1480 B.C. to the actions fought by Allenby's



Esher, Surrey. The main Portsmouth road looking towards Guildford. In the centre of the picture is the old Bear Hotel, set back from the highway

cavalry against the Turks in 1918. The plain, part of modern Israel, has agricultural settlements.

Esdras, THE BOOKS OF. Several works bear the title Esdras. One of these (O.T. Apocrypha) contains substantially the same materials as the Biblical books known as Ezra, Nehemiah, and 2 Chronicles. In the Septuagint and in the Latin and Syriac versions this is called 1 Esdras; but in Latin bibles since the time of Jerome, 3 Esdras (the O.T. books of Ezra and Nehemiah being reckoned as 1 and 2 Esdras). Modern scholars prefer to call it "Greek Esdras." The other work in the O.T. Apocrypha is commonly called 2 Esdras, but sometimes 4 Esdras. It contains seven visions, and is the only specimen of Apocalyptic

Literature in the O.T. Apocrypha. 1 Esdras was used by Josephus, and may have been composed in the first century B.C. 2 Esdras was probably written in the reign of Domitian (A.D. 81-96). The author appears to have witnessed the destruction of Jerusalem in A.D. 70 (chap. 3); and in the Eagle Vision the eagle seems to represent Rome.

Eserine Sulphate. Sulphate of an alkaloid extracted from *Physostigma venenosum*, the Calabar bean. It produces contraction of the pupils, and in minute doses is useful in various affections of the eye. In large doses it is poisonous.

Esh. Village and parish of Durham, England. It is 5 m. W. of Durham, and is a mining centre. Near here, at Ushaw, is the R.C. college of S. Cuthbert, the successor of the one at Douai. It has a collection of pictures and antiquities, while its chapel was designed by Pugin. S. Michael's is the chief church of Esh. Pop. 1,100.

Esher. Urban district of Surrey, England, a residential suburb of London. Esher parish stands

on the Portsmouth Road near the little river Mole, 15 m. S.W. of London by electric rly. Esher Place, built by William of Waynflete in 1460, now represented by a tower, was the residence of Wolsey after his fall in 1529. Viscount D'Abernon built a house on the site, 1895, which was bought by the Electrical Trades Union in 1953 with the intention of making it into a college. One mile S. is Claremont (*q.v.*). Esher gives its name to a county constituency. Pop. (1951) 51,432.

Esher, WILLIAM BALIOL BRETT, 1st Viscount (1817-99). British judge. The son of a clergyman, he was born Aug. 13, 1817, and went from Westminster School to Caius College, Cambridge. In 1840 he became a barrister, and he entered

the house of commons as Conservative M.P. for Helston in 1866, a tie at this election ending in the House allowing both candidates to sit. In 1868 Brett was made solicitor-general, but very soon he left political life to become a judge of the court of common pleas. In 1876 he was promoted to be a lord justice, and in 1883 to be master of the rolls. He retired in 1897, and died May 24, 1899. In 1885 Brett was made Baron Esher, in 1897 Viscount Esher.

Esher, REGINALD BALIOL BRETT, 2ND VISCOUNT (1852-1930). British politician. Born in London, June 30, 1852, he was the son of the 1st Viscount Esher (v.s.). Educated at Eton and Trinity College, Cambridge, he was Liberal M.P. for Penryn and Falmouth 1880-85. He enjoyed the confidence of both Victoria and Edward VII, under whom he was deputy-governor of Windsor Castle. He published *Ionicus*, 1923; *Cloud-Capped Towers*, 1927; and, with A. C. Benson, edited the *Letters of Queen Victoria*, 1907. He died Jan. 22, 1930.

Eshnunna. Ancient Sumerian city. Excavations by the Oriental Institute, University of Chicago, at the site, Tell Asmar in the valley of the Diyala r., 40 m. N.E. of Bagdad, unearthed a palace, temples, and a large residential area of this important city, which was an outpost of the kingdom of Ur in the 3rd dynasty and the centre of a flourishing kingdom in the Old Babylonian period till its destruction by Hammurabi c. 1760 B.C. Tablets bearing part of a code of laws of Eshnunna, found at Tell Abu Harmal near Bagdad, are attributed to its greatest kings, Naram-Sin and Dadusha, and thus antedate the Hammurabi code. Consult *Pre-Sargonid Temples of the Diyala Region*, Delougaz and Lloyd, 1942; *The Laws of Eshnunna*, A. Goetze, 1955.

Eshowe. Town of Zululand, Natal, 40 m. S. of Ulundi. There are asbestos mines in the neighbourhood. It was besieged for a time by the Zulus during the Zulu War of 1879. Here Cetywayo died in 1884. Pop. (est.) 3,600; 1,400 white.

Esk. River of Great Britain. Formed by the confluence of the Black Esk and White Esk, which meet in Eskdalemuir, it flows for 35 m. through Dumfriesshire and Cumberland to the Solway Firth about 5 m. below Longtown.

Esk. River of Cumberland, England. It rises between Scafell Pike and Rossett Crag and flows

about 15 m. generally S.W. through Eskdale to reach the Irish Sea at Ravenglass.

Esk. River of the N. Riding of Yorkshire, England. Rising to the N. of Burton Head, it flows N. and then generally E. across Cleveland, through beautiful woodland scenery, for some 20 m., entering the North Sea between high cliffs at Whitby.

Esk, NORTH. River of Kincardineshire and Angus, Scotland. It is formed by the junction of the Lee and Mark, which unite at Invermark, and flows S.E. for 29 m. to the North Sea, 4½ m. N.N.E. of Montrose.

Esk, SOUTH. River of Angus, Scotland. It rises in the Grampian Mts. above Glen Clova, and flows 49 m. S.E. and E. to the North Sea at Montrose.

Eskilstuna. Town of Sweden, in the county (län) of Södermanland. It stands on the Hjelmars river, between the Mälars and Hjelmars lakes, 65 m. by rly. W. of Stockholm. It has iron-foundries, steel works, a royal arms factory, and a technical school, and is celebrated for its cutlery and damascened work. Named after S. Eskil (d. 1181), the English apostle in Södermanland, it had a 12th-century monastery which was destroyed by fire in 1680. Pop. (1955) 56,384.

Eskimo (Abenaki, raw flesh-eater). Primitive people inhabiting Arctic America. Numbering perhaps 30,000, they have a geographical range of 5,000 m., the widest of any aboriginal group in the world. The Danish form Eskimo has displaced the French Esquimaux. The Hudson Bay "husky," used of man and dog, is a colloquial variant. The native name is Innuít (men). Short, thick-set, long-headed, broad-faced, lank-haired, and of a yellowish brown colour, they have affinities with the American Indians as well as with the mongoloids of N.E. Asia. Their language is remarkably uniform, and though there are many dialects, these are to some degree mutually intelligible. While this suggests fairly recent expansion throughout their territory, archaeological discoveries show that they have occupied some areas for at least 2,000 years. A pre-American habitat in N. Siberia is a reasonable inference. Some Eskimos are still found W. of the Bering Strait. There is some variation in the emphasis placed on different ways of life and forms of food, according to position. A few groups live entirely

inland and depend primarily on hunting caribou. The majority migrate seasonally, hunting seals on the coast in winter and spring, and caribou inland in the summer. Their material culture reaches a high degree of development, as is demonstrated by their bone arrowheads, shaft-straighteners, harpoons, and ornaments, their stone lamps and ivory engravings—almost reaching picture-writing. Their one-man skin canoes (kayak), transport boats (umiak), summer tents of skin, winter huts of turfed stone, migrant snow-houses (igloo), harpoon floats, dog sledges, cairn-burials, all show intelligent adaptation to adverse conditions.

Their animism embraces a crude magic, governed by medicine-men (angakok). Their communal life recognizes no national chiefs; tribal warfare is unknown. Their ample folk lore points to a belief of some tribes in a woman of the sea, of others in a moon-god. The Aleuts of the Aleutian Islands are linguistically related to the Eskimos. A tribe of blond Eskimos was discovered by Stefansson during his 1909-11 expedition on Coronation Bluff, far in the Arctic zone.

Bibliography. *The People of the Polar North*, K. Rasmussen, Eng. trans. 1908; *The Labrador Eskimo*, E. W. Hawkes, 1916; *My Life with the Eskimos*, V. Stefansson, 1919; *The Eskimos: their environment and folkways*, E. M. Weyer, 1932.



Eskimo Dog. Specimen of the breed, closely akin to the wolf

Eskimo Dog. Breed of dogs kept by the Eskimos of Arctic America. They are little more than domesticated wolves of the region. The practice of crossing



Eskimo man in hunting dress

the females with wild wolves tends to check those modifications which domestication produces. The Eskimo dog has a sharp muzzle, upright ears, rough coat, and a bushy tail. Though usually of the colour of the wolf, black-and-white specimens are not uncommon. Like the wolf, it does not bark, but howls. The dogs are fed on frozen fish, but in spring often find birds and eggs. Their usual drink is snow. They are employed for sledge drawing, about eight being yoked together. When the going is good a dog will draw on an average over 300 lb. for 35 m. in a day. See Dog colour plate.

Eskishehr OR **ESKISEHIR** (Turk., old city). Town of Asiatic Turkey, the ancient Dorylaeum, capital of a vilayet with the same name with rich deposits of meerschaum. The town, on the Pursak Su, is the junction at which the main rly. from the Bosphorus divides into two, one branch going E. to Ankara and the other S.W. to connect on the W. with the Izmir rly. and on the E. with the Bagdad rly. It has sulphur springs (122° F.). Pop. (1955) vilayet, 324,614; town, 122,755. The battle of Dorylaeum, July 1, 1097, was a notable victory for the Crusaders under Godfrey de Bouillon over the Seljuks.

Esla. River of Spain. It rises on the S. slopes of the mts. of Asturias, in the N. part of the prov. of Leon, and flows a generally S.S.W. course to discharge its waters into the Douro, 16 m. W. of Zamora. It has a length of 120 m.

Eslava, MIGUEL HILARION (1807-78). Spanish composer. Born near Pampeluna, Oct. 21, 1807, he became master of the choir in Ossuña cathedral in 1828. He moved to Seville in 1832, and was appointed *maestro* at the cathedral, and to a similar position at the court of Isabella in 1844. He died at Madrid, July 23, 1878. He wrote three operas, *El Solitario*, 1841; *Las Treguas de Toleda*, 1842; *Pedro el Cruel*, 1843; and about 150 masses and pieces of ecclesiastical music.

Esmarch, JOHANNES FRIEDRICH AUGUST VON (1823-1908). German surgeon. Born Jan. 9, 1823, at Tönning, Schleswig-Holstein, he served in the wars of 1848 and 1864, and, in the Franco-Prussian war, 1870-71, was surgeon-general to the army. He specialised in hospital management and military surgery. He invented an indiarubber bandage for field work and temporary dressing. He died at Kiel, Feb. 23, 1908.

Esmeraldas. Maritime dept. of N.W. Ecuador, lying S. of Colombia. The surface is broken and hilly, but there are the open pasture valleys of the Esmeraldas, Cayapas, and other rivers. The hills are heavily forested, yielding many kinds of timber, also tobacco. Although the mineral resources have not been largely exploited, gold and platinum are found. Area, 5,464 sq. m. Pop. 58,950. Esmeraldas, the capital, is a Pacific port at the mouth of the Esmeraldas, 96 m. N.W. of Quito. It manufactures tobacco and exports rubber, cacao, sugar, fruit, and cattle. Pop. 4,000.

Esmond, HENRY. Central character in Thackeray's novel of the same name. Its full title is *The History of Henry Esmond*, a colonel in the Service of Her Majesty Queen Anne, Written by Himself. Published in 1852, it is a masterly presentation of early 18th century life and manners; the illusion as to its having been written by a man of the very time with which it deals is brilliantly sustained. The hero tells his own story from boyhood. It not only includes an account of the campaigns of Marlborough, but introduces the finely conceived character of the wayward Beatrix, most imperious of mistresses, true to her period and fascinating for all time.

Esmond, HENRY VERNON. Stage and pen-name of Henry Vernon Jack (1869-1922), British dramatist and actor. He was born at Hampton Court, Nov. 3, 1869, was educated privately, and went on the stage in 1885. He was the author of many plays, some of which enjoyed considerable popularity: *Bogey*, 1895; *One Summer's Day*, 1897; *The Wilderness*, 1901; *Under the Greenwood Tree*, 1907; *A Young Man's Fancy*, 1912; above all, *Eliza Comes to Stay*, 1913 (previously called *Sandy and His Eliza*); *The Dangerous Age*, 1914. He died April 17, 1922.

Esneh OR **ESNA**. Town of Egypt. It is on the left bank of the Nile, 36 m. by rly. above Luxor. It is identical with the *Tesnet* of ancient Egypt, but was called *Latopolis* by the Greeks, after the locally venerated *latos* fish. The chief object of interest is the temple of Khnum, which was embellished by Roman emperors from Titus to Decius (251). A subterranean Coptic church was identified here in 1895. The barrage at Esneh ensures irrigation for a large tract of land.

Espagnols-sur-Mer (Fr., Spaniards on the sea). Name given

to a sea fight that took place off Winchelsea between the English and the Castilians, Aug. 29, 1350. The two peoples were not actually at war, but the Castilians had helped the French in the war then raging. Moreover, acts of piracy had been committed on both sides.

The sequel was an attack on a Castilian fleet of armed merchantmen as it was returning from the Netherlands to Spain. Under the command of Edward III the English fleet was assembled at Winchelsea, and there the Castilians, nothing loth, joined battle with them. This was rather an encounter of soldiers than of sailors. Crossbowmen on the Castilian ships did much execution, and as the English and Castilian ships lay side by side, the crews fought hand to hand. In the cog *Thomas*, King Edward and his nobles took a gallant part, and this ship was sunk just as the royal party had boarded an enemy vessel. Forty or fifty ships were engaged on either side, the Castilians being the larger. Night, rather than a decision, put an end to the combat, which is described by Froissart.

Espalier (Fr.). Shape or form of fruit-tree which has been trained from its earliest or budded



Espalier. Pear tree trained to grow in this way upon a trellis

stage. An espalier consists of a main root stem, the original stock, from which fruit branches in tiers extend horizontally right and left, one above another. During the year after budding, when the side-shoots make their appearance, all should be removed except three, which should be grouped close together. One of these shoots is trained upwards to form a continuation of the main stem, and the remaining couple are coaxed by sticks and strings to grow right and left, parallel with the surface of the ground. When the main stem produces three more buds suitably situated the process is repeated at a distance of about one foot above the original tier. The

attempted an abortive *coup d'état*, was arrested but released, and after the mporet's departure made himself head of the provisional government, Oct. 5, 1914.

In Jan., 1916, he sided with the Allies. In Feb. the Austrians overran Albania, and Essad escaped to Salonica. His connexion with the Serbians, whom he had aided in their 1915 retreat, made him distasteful to the Italians who occupied Albania after the Austrian retreat, 1918, and he was not allowed to return there. He lived for some months in Paris, and was murdered by an Albanian student, June 13, 1920.

Es Salt. Village of Jordan. Identified as the ancient Ramoth (Deut. iv, 43; Josh. xx, 8), it is 15 m. N.E. of the crossing of the Jordan at El Ghoraniyeh, 20 N.E. of the N. end of the Dead Sea. Situated at an elevation of 2,740 ft. above the sea, it is the capital of the Kadā (division) of El-Belkā. Wine and raisins are produced in the district. The inhabitants are two-thirds Moslems, the rest Greeks, Protestants, and Roman Catholics. During the First Great War it was a depot of the Turks, who when they retired from it, April 1, 1918, brought away some thousands of Jewish, Syrian, and Armenian refugees. On April 30 Allenby resumed operations E. of the Jordan, and Australian mounted troops entered Es Salt. It was evacuated May 3, when Allenby withdrew his whole force to the Jordan crossings. See Palestine, Conquest of.

Essay (Fr. *essai*, attempt; Lat. *exigere*, to examine). Literary composition, generally in prose, of a short and informal character. The origin of the word is the same as that of *assay*, for at first it was taken as indicating a testing or trying of a subject. The word has, however, at different times been applied to a great variety of compositions, embracing at once the sententious brevities of Bacon and the fullness of such a philosophical work as that of Locke, On the Human Understanding. It is also applied to certain of the didactic poems of Pope.

Montaigne (16th century) is generally regarded as the originator of the modern essay, as he was the first to employ the word as title for his pleasantly discursive and personal writings; yet, as Bacon, the earliest notable master of the English essay, wrote, "the word is late, but the thing is ancient." Bacon's Essays, 1597, are mainly a succession of pithy maxims, and differ greatly from the essay as it was evolved during the succeeding centuries; for it was rather from

the Frenchman than from their countryman that the English essayists derived. Ignoring its use as something of an apologetic prefix to philosophical and historical studies, and its employment in poetry by Pope and some of his imitators, the history of the essay in English literature may be followed in a record of some of its exponents.

Abraham Cowley, the first English author to write in the easy, familiar, personal style of Montaigne, though he frequently rounded off his essay with a poem on its theme, or wrote the essay as little more than introduction to a poem, may be called the father of the familiar essay in English. It was with Richard Steele and Joseph Addison that the essay established itself as a popular form of literary composition. Their personal studies in essay form in *The Tatler* and *The Spectator* are regarded as adumbrating the English novel; as two laughing philosophers, with their genial comment on men and affairs in periodical essays, they established a form of the composition which continued throughout the 18th century.

In the hands of Daniel Defoe early in that century, the periodical essay received that particular bent out of which developed the newspaper leader. Towards the middle of the century the periodical essay was revived in *The True Patriot*, *The Rambler*, *The Covent Garden Journal*, *The Adventurer*, *The Idler*, *The Bee*, *The Citizen of the World*, and many more, and found its most notable writers in Henry Fielding, Samuel Johnson, and Oliver Goldsmith. These various works were brought together in *British Essayists*, with prefaces by A. Chalmers, 45 vols., 1817.

With the 19th century the essay branched more definitely into two main kinds, both already, but less distinctly, differentiated, the familiar and the critical essay. Of the writers of the former kind the greatest exemplar is Charles Lamb, whose *Essays of Elia*, 1823, *Last Essays of Elia*, 1833, and uncollected essays may be said to have influenced many of his successors up to the present day. At the same period William Hazlitt was writer of essays of a more robust character, and Leigh Hunt was master of a dainty, graceful essay style, less charmingly individual than that of Lamb. The critical essay received a stimulus from the establishment of the quarterly reviews and the rapid growth of the magazines, Francis Jeffrey, Sydney Smith, and Thomas Babington Macaulay being among its most notable exponents.

Bulwer Lytton, W. M. Thackeray, J. A. Froude, Matthew Arnold, all favoured the essay form at times, but names that come more readily to the mind today in thinking of English essayists are R. L. Stevenson, Austin Dobson, Augustine Birrell, Alice Meynell, A. C. Benson, E. V. Lucas, Hilaire Belloc, G. K. Chesterton, Robert Lynd, A. A. Milne, J. B. Priestley, Aldous Huxley, and notably that charming exponent of the form, Violet Paget, famous as "Vernon Lee." Among later English writers who are essayists rather than literary critics, George Orwell is outstanding. In America, Ralph Waldo Emerson has been the most eminent essayist, though Oliver Wendell Holmes, James Russell Lowell, Hamilton Wright Mabie, Agnes Repplier, Paul Elmer More, should be mentioned. H. L. Mencken and many other of his contemporaries have practised the essay with distinction.

Essay on Man, AN. Moral poem by Alexander Pope. It takes the form of four epistles to Lord Bolingbroke, who is supposed to have suggested the theme, and was published anonymously in 1732-34. Though it has been objected that the author was hampered by the metaphysical nature of his subject, and gives no consistent scheme of beliefs, the Essay will always be remembered for the many terse sentences it has added to the great body of familiar quotations.

Essays and Reviews. Volume by seven writers, six of them clergymen of the Church of England. On its publication in 1860, its rationalistic tendencies aroused a storm of criticism. Two of the clergymen—Williams and Wilson—were suspended by the ecclesiastical courts, but the suspension was revised on appeal to the Privy Council, when, as it was said, Lord Chancellor Westbury "dismissed eternal punishment with costs." The contents of the volume were: *The Education of the World*, Frederick Temple; *Bunsen's Biblical Researches*, Rowland Williams; *On the Study of the Evidences of Christianity*, Baden-Powell; *The National Church*, H. B. Wilson; *The Mosaic Cosmogony*, C. W. Goodwin; *Tendencies of Religious Thought in England, 1688-1750*, Mark Pattison; and *The Interpretation of Scripture*, Benjamin Jowett.

Essays of Elia. Volume of familiar papers on various themes by Charles Lamb, published in volume form in 1823 after appearance in *The London Magazine*, and supplemented in 1833 by the *Last Essays of Elia*. These essays, varying from grave to gay, pervaded

with delightful fancy and rich in humour and tenderness, reveal much of the life and character of the author. They not only include the best of Lamb's work, but stand alone and unchallenged as the supreme collection of familiar essays in the English language. *Pron. Ellia. See Lamb, Charles.*

Essen. City of Germany. It lies 20 m. N.E. of Düsseldorf, and is the main centre of the Ruhr industrial area. Seat of the original Krupp armament plants (demilitarised in 1946), of Germany's chiefmining companies, and of nearly 7,000 other industrial enterprises with, together, some 200,000 workers and employees, Essen's growth was phenomenal: from 57,000 in 1880 to 659,871 in 1939. During the Second Great War the city was almost destroyed by bombing. It was a principal rly. and canal shipping centre, and, around the old and the industrial towns, had developed spacious suburbs. Villa Hügel, the Krupp mansion, was famous; and there existed remarkable remnants of the old town, such as the minster church, built in 852 (most of which survived the bombing), and in the suburb of Werden a Benedictine church also of the 9th century. Pop. (1950) 605,411.

Modern buildings of merit included the stock exchange, Folkwang museum, banking and business palaces, schools, etc., and model settlements and welfare institutions. Essen arose as a Benedictine nunnery in the 10th century, was first mentioned as a town in 1003, and, under a princess-abbess, was protected by the counts, later dukes, of Jülich-Cleves-Berg. Inherited by Brandenburg electors, it was secularised 1803, became Prussian in 1814, and the centre of French Ruhr occupation in 1923. Taken by troops of the U.S. 9th army, April 9, 1945, it was included in the British zone of occupation in Germany. *See Krupp.*

Essen, HANS HENRIK, COUNT (1755-1824). Swedish soldier and statesman. Born in West Gothland, Sept. 26, 1755, and educated at Uppsala, he entered the army. He became a favourite of Gustavus III, whom he accompanied in the war against Russia, 1788-90, and whose assassination he witnessed in 1792. In 1795 he was appointed governor of Stockholm. From 1800

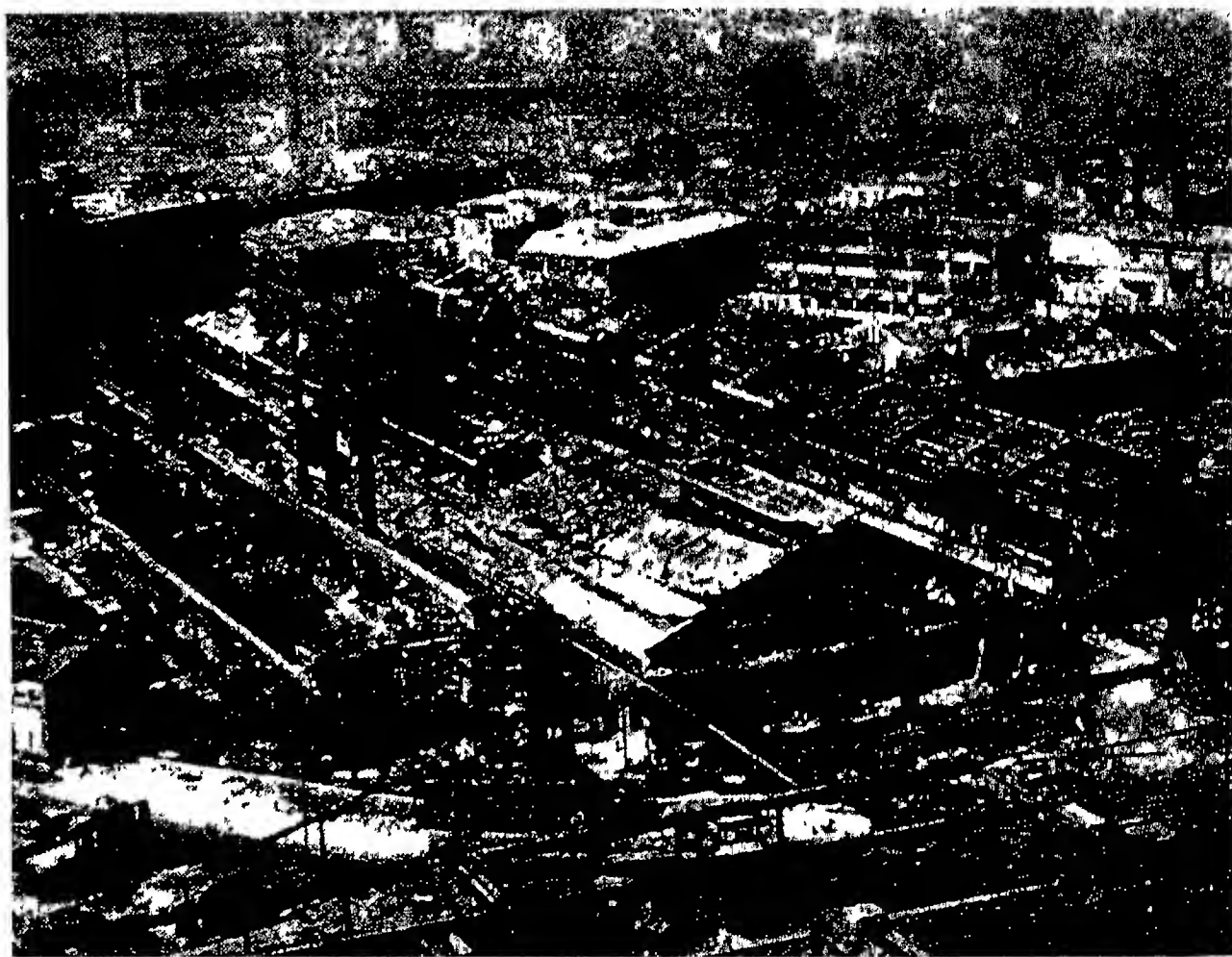
to 1807 he was governor-general of Pomerania and distinguished himself by a stubborn defence of Stralsund against the French. In 1810 he negotiated a peace with France by which Pomerania was restored to Sweden and in 1811 was promoted field-marshal. In 1813 he commanded the successful expedition against Norway, and was governor there, 1814-16. He died at Uddewalla, June 28, 1824.

Essence (Lat. *esse*, to be). The sum of the permanent, constitutive qualities which make an existing thing what it is. The name quintessence (fifth essence) was given by Aristotle to ether, the other four being fire, water, earth, air. Essence is now used to denote the best and purest part of anything. As a theological term, essence or substance (*ousia*) is used of that which is common to the three Persons of the Trinity, in contrast

Essenes. Ancient Jewish sect. It sought to combine the ascetic practices of the Jewish religion with various Oriental tenets and rites. Probably an offshoot of the older sect of the Chasidim or Assideans, it would appear to have originated in the days of the Maccabees (2nd century B.C.). The Essenes believed in one God and in eternal predestination. While maintaining the immortality of the soul, they denied the resurrection of the body; and they held a Greek view of future rewards and punishments. Strongly opposed to an official priesthood, they refused to take part in the Temple sacrifices, but held ceremonial feasts with prayer in their own houses. They led very austere lives, some living in community under a kind of monastic rule, while others lived apart in contemplative solitude. Community



Essen arms



Essen. This important industrial city of Germany was severely damaged in the Second Great War by Allied bombing. Among factories put out of action were the Krupp works, of which a section is shown in this air view

with *hypostasis* (person), which refers to the special characteristics of each Person.

Essence. Strong flavouring used in puddings, cakes, and sweets. It is made by extracting or distilling the volatile oil from plants, seeds, or kernels, such as vanilla, coriander, musk, anise, nutmeg, peppermint, and coffee. Ratiafia is prepared from bitter almonds and other kernels and orange peel. Essence of rennet is made from the stomach of the calf, and when poured into milk produces curds. Beef essence or extract is used in the making of gravies, and also as a stimulant for invalids. *See Essential Oils.*

of good was practised, and the time was divided between prayer, study of the sacred books, and agriculture.

Later, becoming tainted with the Gnostic tenets of the essential evil of matter and the dualistic origin of the universe, they abstained from flesh, wine, and marriage. They paid peculiar reverence to certain angels, and sometimes practised a form of sun worship. Strongly opposed by orthodox Jews, though favoured by the Herods, they were cruelly persecuted by the Romans. They had a settlement near the Dead Sea; Josephus estimated the stricter Essenes of his day at

about 4,000. The sect died out before the 3rd century. *Pron.* Es-seenz. -See Jews.

Essential Oils. These oils, sometimes known as volatile oils, almost exclusively of vegetable origin, possess in concentrated form the odour of the plant parts from which they are derived. Oils in this group are readily obtained by distillation or other means from the flower petals, macerated leaves, grasses, stems, and fruit rind of members of the great botanical families Coniferae, Compositae, Labiatae, Lauraceae, and others. The most important and familiar oils in this group are those of peppermint, eucalyptus, cinnamon, clove, lavender, camphor, citronella, and turpentine. The main centres of production are the south of France, countries bordering the Mediterranean Sea, S.E. Europe, French African colonies, East Indies, India and Ceylon, and, for pine oils, Russia, the U.S.A., and Canada.

Sources of Important Oils

Different oils concentrate in different parts of plants, which thus serve as raw materials. From the rind of the fruits of various citrus plants, lime, lemon, bergamot, and orange, oils are obtained; from berries are derived juniper and pimento oils; from flowers, lavender oil. Ripe seeds of species of culinary herbs are the source of the food flavouring oils of celery, caraway, marjoram, sage, thyme, fennel, and anise. The needles and cones of various conifers—firs, pines, larches, and spruce—yield pine-needle oils. Eucalyptus oils are derived from the leaves and terminal branches of the many species known to Australians as blue gums, which comprise in their 300 species 75 p.c. of the vegetation of Australia. Orris and ginger are produced from rhizomes; clove oil from immature flower buds; angelica and vetiver oils from roots; the whole dried plant is used for peppermint oil; of the camphor tree every part is utilised in making camphor and camphor oil.

Essential oils and other naturally occurring perfumery raw materials are now obtained from crops so widely scattered over the world that new crops become available every month of the year. Thus in March the violet, clove, and Bourbon geranium are available; in Sept., aniseed, jasmine, Ceylon citronella, English lavender, English and American peppermint, spearmint, French geranium.

Chemically, essential oils consist largely of hydro-aromatic

hydrocarbons, known as terpenes, and are of the empirical composition $C_{10}H_{16}$; associated with these terpenes are their many alcoholic, aldehydic, ketonic, and ester derivatives, and it is to these secondary constituents that an oil frequently owes its aroma. Practically all essential oils are liquids, of boiling point around 160° – 180° C., generally insoluble in water but freely soluble in alcohol, ether, and other common organic solvents, and in fats and fatty oils.

Some essential oils are obtained by solvent extraction of the raw material, but the commonest method is to make use of the property of volatility in steam common to all. Dry, chopped up, or macerated raw material—grasses, berries, leaves, bark, etc.—is placed in stills and steam passed through the mass. The still may hold tons of material; reduced pressure may be resorted to, and the steam which passes through is condensed and subsequently the oil separated from the resultant water mixture. The oil yield varies from less than 1 p.c. of the raw materials treated for pine-needles and many grasses, to 17 p.c. for bay leaves.

Methods of Extraction

Oils of the citrus group are best obtained by expression, usually in small hand-operated presses, from the fruit rind. West Indian lime oil, however, is generally distilled from the rind of the fruit. For jasmine, orange flowers, tuberose, and some other flower oils, enfleurage is preferred in the south of France: here the flower essence is absorbed by a thin coating of fat on which the flowers are placed. American, French, and Russian pine oils are obtained as an exudation from the bark of the tree, such oils on distillation yielding turpentine and a solid residue of colophony or rosin, the last being used in the soap, varnish, and paper-making industries.

However obtained, many of these oils, notably the floral ones, are used in general perfumery purposes, soap, and cosmetics. Eucalyptus and juniper have medicinal and pharmaceutical applications. Anise and caraway are used in cordials and liqueurs, while lemon, lime, orange, peppermint, and anise find application in flavouring. Some essential oils have germicidal properties, e.g. oil of thyme, eucalyptus, and pine-needle oils, the latter often in antiseptic sprays and inhalants. Some species of eucalyptus and

pine oils help in the modern froth-flotation method of treating mineral ores.

Uses of Essential Oils

A word must be said about essential oils as the raw materials for the manufacture of chemical substances important in the perfumery and flavouring industries. Safrol, present in oil of camphor and notably in oil of sassafras, can be converted by a series of operations into heliotropin, a white crystalline substance with an odour of the heliotrope flower. Citral, present to the extent of 75 p.c. and upwards in lemongrass oil, and also in small amounts in oil of lemon, can be converted into a class of substances known as ionones, which when diluted have the odour of violets and impart freshness, delicacy, and volatility to perfumes. From some pine oils can be obtained the terpene hydrocarbon pinene, which, by a series of chemical operations is converted into synthetic camphor. Turpentine, a thinner in the paint industry, can be converted into terpineol, a substance used in almost every compounded perfume and valued because of its stability and its pronounced lilac odour. Terpinolene, also derived as a by-product from turpentine, is used to make disinfectants, especially those of the spray type. Clove oil contains upwards of 85 p.c. of eugenol, to which the oil owes its odour. Large amounts of eugenol extracted from clove oil are converted into the crystalline flavouring material vanillin, which formerly could be obtained only from vanilla beans. The principal essential oils, and plant sources from which they are derived are the subjects of specific articles. See Fixed Oils; consult also The Essential Oils, H. Finckmore, 1926; The Volatile Oils, E. Gildemeister, 1926.

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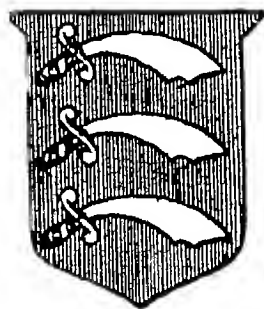
Essential Work Orders. The regulations issued by the minister of Labour on March 7, 1941, to prevent loss of production, through unnecessary changes of job by workers in certain undertakings scheduled as being engaged on work essential to the prosecution of the Second Great War. In a scheduled undertaking the management's right to dismiss employees, and employees' right to leave their employment, became subject to the written permission of a national service officer. Employees could be discharged only for serious misconduct, and any

employees absenting themselves without leave or reasonable excuse, or being persistently late, could be reported to an officer. At first these orders applied chiefly to industries directly engaged in making munitions, but later amendments extended control to all industries, and workers could be directed to specific industries. The orders were gradually relaxed after the war, and by 1950 the last (applying to agriculture and coal-mining) were abolished.

Essequibo. Settlement and river of British Guiana, S. America. The settlement extends to the Venezuelan frontier and borders on the Atlantic Ocean for 120 m. It contains locust trees, iron wood, ebony, greenheart, and other hardwood trees. It was the subject of rival claims, settled by the arbitration treaty of Feb. 2, 1897, between Great Britain and Venezuela.

The river rises near the equator, among the mountains on the Brazilian border, and flows N., entering the Atlantic near Georgetown through a long estuary, from 15 m. to 20 m. wide, containing several islands. Its length is about 600 m., only 40 m. being navigable to vessels of deep draught, owing to cataracts; its mouth is impeded by sand bars. The largest river of the colony, it receives important tributaries, *e.g.* the Rupununi, Masaruni, Cuyuni, and the Pólaro.

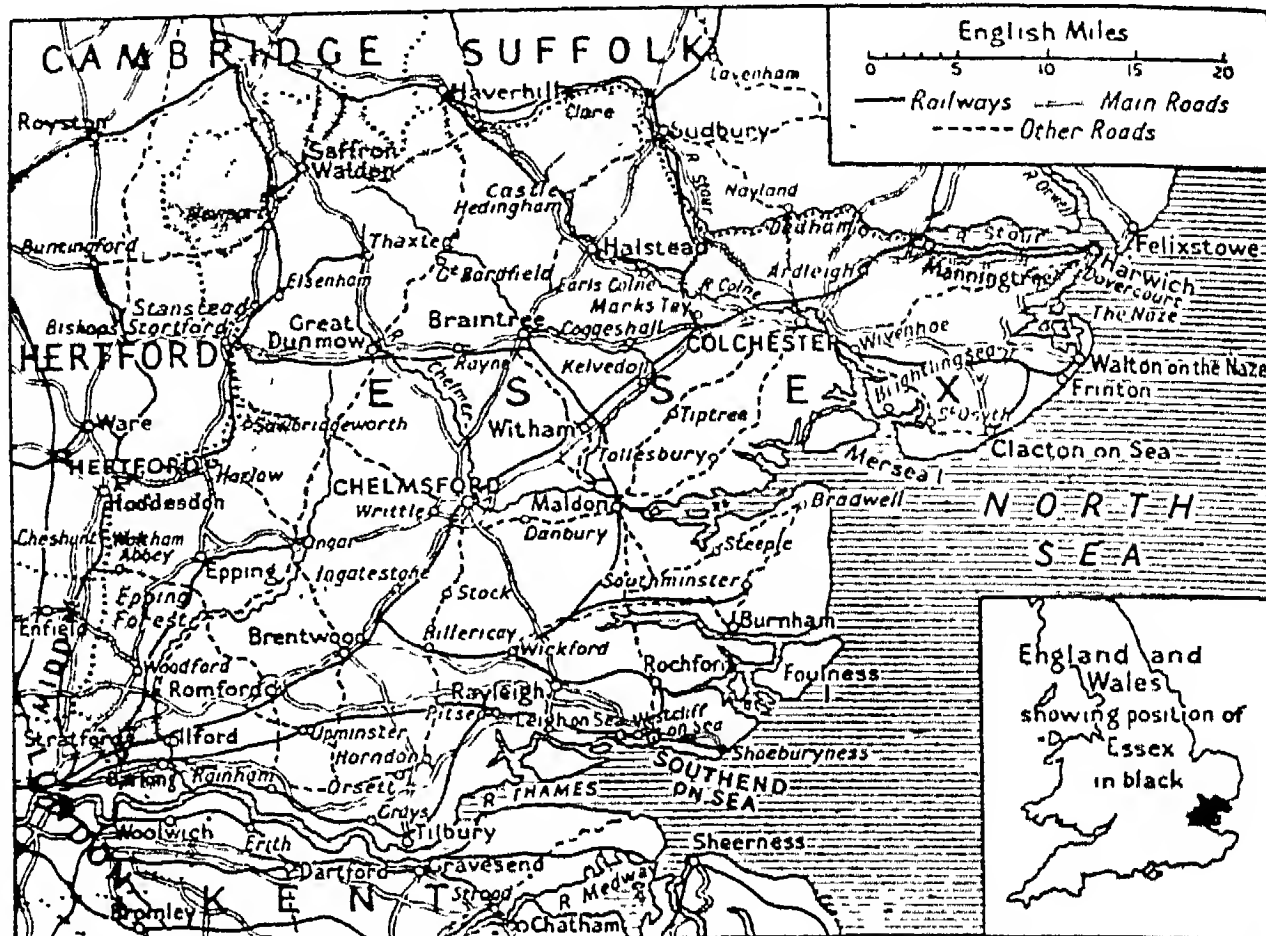
Essex. Agricultural and maritime county of S.E. England. It is bounded S. by the Thames, E. and S.E. by the North Sea, N. by Suffolk and Cambridgeshire, and W. by Hertfordshire and Middlesex. Its area is 1,530½ sq. m. Some 90 m. of seaboard, indented by



Essex arms

several estuaries, is marked by low-lying islands: Canvey, Foulness, Wallasea, Mersea, etc. The chief rivers are the Thames, Lea, Stour, Colne, Chelmer, Blackwater, Crouch, and Roding. While the coastal region is flat and marshy, there is comparatively high ground in the N.W. and centre, the highest points being reached at High Beech, Epping Forest (*q.v.*); Danbury, between Chelmsford and Maldon; and in the Laindon Hills.

The forest of Essex, known after the early part of the 14th century as the forest of Waltham, has dwindled to the present day Epping Forest, a public possession since 1882. Chelmsford is the co. town and seat of a bishop; Col-



Essex. Map of this deeply indented county, showing its relation to the London area

chester, Maldon, Saffron Walden, Romford, and Braintree are other towns, with Barking, Dagenham, Ilford, East and West Ham, in the London area. Harwich is the chief port. Southend-on-Sea, Clacton-on-Sea, Frinton-on-Sea, Walton-on-the-Naze, and Dovercourt are popular holiday resorts. The county forms ten county constituencies and sixteen borough constituencies.

The county, described by Norden in 1594 as "fatte, fruteful, and full of profitable things," produces wheat, barley, and fruit. Apart from brewing (Romford) and engineering (Colchester), the manufacturing industries are largely confined to the metropolitan area, in which is the bulk of the population. The Crouch, Blackwater, and Colne have oyster beds; the Colchester oyster feast, an annual event (Oct. 20), dates from early times. There is a gunpowder factory at Waltham Abbey, and the Tilbury Docks and Victoria Docks (Plaistow) are on the Thames. Yachts and pleasure boats are built at Burnham-on-Crouch, a popular yachting centre.

In the 1st century B.C. Essex was the home of the British tribe of the Trinobantes. Later the kingdom of the East Saxons, it became the scene of many conflicts between Saxons and Danes. William of Normandy laid a heavy hand upon it. In the 12th century it gave its name to an earldom created by Stephen in favour of Geoffrey de Mandeville. From the 7th until the middle of the 19th century it was ecclesiastically attached to the see of London. It was next linked first to

Rochester and then to St. Albans. In 1914 the see of Chelmsford was founded. There are bishops suffragan of Colchester and Barking.

The county is rich in prehistoric, Roman, Anglo-Saxon, medieval, and monastic remains. It has many notable churches and some fine old houses, Audley End among them, while the remains of Norman castles, *e.g.* Colchester and Hedingham, and the fragment at Hadleigh, bear witness to the Norman occupation. Rainfall is low. An earthquake on April 23, 1884, damaged 1,200 houses between Colchester and the Blackwater. The great tide of Jan. 31-Feb. 1, 1953, flooded 49,000 acres of the county. Pop. (1951) 2,044,964.

LITERARY ASSOCIATIONS. In Chigwell is the gabled King's Head Inn described as The Maypole in Dickens's *Barnaby Rudge*. The Rose Inn at Peldon and the marshes figure in Baring-Gould's *Mchalah*. Miss Braddon laid the scene of *Lady Audley's Secret* at Ingatestone. John Locke, philosopher, spent ten years and was buried at High Laver. John Ray, botanist, was born and died at Black Notley; Thomas Tusser, author of *Five Hundred Points of Good Husbandry*, 1573, was born at Rivenhall; Sydney Smith at Woodford; Isaac Taylor at Ongar; Francis Quarles near Romford. Dr. William Harvey was buried at Hempstead near Saffron Walden. More recently S. L. Bensusan wrote a series of tales and short stories about the marshlands. H. G. Wells lived for some years at Easton and described it as *Matchings Easy* in *Mr. Britling Sees It Through*; while

Arnold Bennett, residing at Thorpe-le-Soken, introduced Frinton in Mr. Prohack. The Victoria History of the co., 1904-07, was revised 1950.

Essex, EARL OF. English title now held by the family of Capell. There were earls of Essex soon after



Walter Devereux,
1st Earl of Essex
From a portrait in
the collection of
Baron Bayot

the Norman Conquest, including Geoffrey de Mandeville (d. 1144). His sons followed him, after which the earldom came to the Bohuns. This family became extinct in 1373, when the title passed to

Thomas of Woodstock, duke of Gloucester, who had married one of the heiresses of the Bohuns. Henry Bourchier, a grandson of Gloucester, was the next earl, but his family died out in 1540. Thomas Cromwell was earl of Essex in 1540, and William Parr, marquess of Northampton, in 1543, but in both cases the title died with the holder.

The family of Devereux was related to the Bourchiers, and probably for this reason Walter Devereux (1541-76) was made earl of Essex in 1572. He married a daughter of Sir Francis Knollys, and spent three years in unsuccessful efforts to colonise Ulster, whither he went with a small army in 1573. He was succeeded by his son Robert, the favourite of Queen Elizabeth I. With the death of the 3rd earl in 1646, the title became extinct.

In 1661 Arthur Capel was made earl of Essex. He was succeeded in 1683 by his son Algernon, and the title is still held by his descendants. In 1916 Algernon (b. 1884) became the 8th earl. An eldest son is called Viscount Malden.

Essex, ROBERT DEVEREUX, 2ND EARL OF (1566-1601). English soldier and courtier. Eldest son of the 1st earl, he was born at Netherwood, Herefordshire, Nov. 19, 1566, educated at Trinity College, Cambridge, succeeded his father in 1576, and was general of horse under his stepfather Leicester in the Netherlands, 1585-86, being knighted for gallantry at Zutphen.



Robert Devereux,
2nd Earl of Essex
After Hilliard

He continued Leicester's court feud with the party in which the Cecils and Raleigh were prominent, but became a favourite of the queen, though his lack of self-control led to quarrels, and his marriage with the widow of Sir Philip Sidney especially angered her.

Essex took part in Drake's expedition to Portugal, 1589, commanded an expedition to Normandy, 1591, secured the conviction of Roderigo Lopez for conspiracy against the queen's life, 1594, distinguished himself at the capture of Cadiz, 1596, lost favour by the failure of the Islands, or Cadiz Voyage, 1597, but was master of ordnance, earl marshal, informal foreign secretary to the queen, and chancellor of Cambridge. In 1599 he was appointed governor-general of Ireland, and, returning without leave from his attempt to suppress the rebellion of O'Neil, earl of Tyrone, with whom he was accused of making a dishonourable treaty, he was dismissed from office and imprisoned from Oct., 1599, to Aug., 1600.

Thwarted in his efforts to regain influence at court, and broken in health, he was implicated with Southampton and others in an attempt to secure the dismissal of the queen's advisers. He attempted a rising in London, was arraigned, and beheaded Feb. 25, 1601. Bacon, whom he had befriended, appeared against him on his return from Ireland, and with Raleigh was largely responsible for carrying out the death sentence, to which Elizabeth reluctantly consented. The story that the queen gave Essex a ring, the return of which would have ensured his pardon, is generally discredited, though what was described as the identical ring was sold at Christie's, May 19, 1911, for £3,412. Essex was fearless but headstrong, generous, a popular favourite, but utterly lacking in statesmanship. He was a writer of sonnets and masques.

Bibliography. Lives and Letters of the Devereux, Earls of Essex, W. B. Devereux, 1853; Bacon and Essex, E. A. Abbott, 1877; Elizabeth and Essex, G. L. Strachey, 1928; Life and Death, G. B. Harrison, 1937; The Unhappy Favourite, J. Banks, 1939.

Essex, ROBERT DEVEREUX, 3RD EARL OF (1591-1646). English soldier. Son of the favourite of Queen Elizabeth I, he was restored in 1604 to the title his father had lost, James I being then on the throne. He was chosen as one of the companions of Henry, prince of Wales. In 1620 Essex went with a force

to recover the Palatinate for the elector Frederick, and in 1625 with the fleet that sailed to capture Cadiz. In 1639 he held a command in the army sent by Charles I against rebel Scots in the first Bishops' War, after which

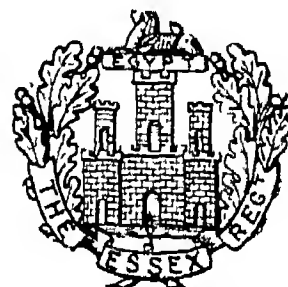


Robert Devereux,
3rd Earl of Essex
After Walker

there was an estrangement between him and the king. On the outbreak of the Civil War Essex took the side of the parliamentarians, and was appointed general of their forces. The earl led the army at Edgehill, relieved Gloucester, and fought the first battle of Newbury. He proved his incapacity when, after leading his army into Cornwall, he left it to surrender at Lostwithiel, himself escaping by boat. He resigned when the self-denying ordinance was passed in 1645, and died Sept. 14, 1646.

Essexite. Crystalline igneous rock named after Essex co., Mass., U.S.A. Akin to gabbro, which it resembles, but richer in soda and potash than the normal types, it contains purple or green varieties of augite, lime feldspar (labradorite), potash feldspar, and a little analcite or nepheline. Soda-hornblende, olivine, or biotite may also be present.

Essex Regiment. Regiment of the British army. Formerly the 44th Foot raised in 1741, it was given the title of the East Essex Regiment in 1782. In 1881 the unit was amalgamated with the 56th Foot and received its present title. The regi-



Essex Regiment
badge

ment took part in the siege of Gibraltar (1779-83), gaining the Castle and Key and the word Gibraltar on its colours. It fought in the West Indies and the American War of Independence, and served with Wellington throughout the Peninsular War. The Essex were at Waterloo, and served in the China War, the Crimea, the Indian Mutiny, the Nile Campaign (1884-85) and the South African War. They raised 31 battalions for service in the First Great War, earning the battle honours Le Cateau; Marne, 1914; Loos; Somme, 1916, '18; Arras, 1917, '18; Cambrai, 1917, '18; Scle; Gallipoli, 1915, '16;

and Gaza. During the Second Great War, the Essex fought in the battle of France (1940), with the 8th army in Africa and Italy, and took part in the invasion of the Continent and the subsequent campaign in France and Germany. The regimental depot is at Warley.

Es Sinn, ATTACK ON. British operations, Jan.-May, 1916. After his retreat from Ctesiphon, Mesopotamia (now Iraq), General Townshend was closely invested by the Turks at Kut-el-Amara, Dec. 3, 1915, and a relief force was organized under General Aylmer. To reach Kut the Indo-British forces had to storm several positions on the Tigris. The British base camp was Imam Ali Gherbi; and the final objective was the strong entrenched position of Es Sinn, 7 m. E. of Kut. Delayed by adverse weather, Aylmer was unable to make any considerable movement until March 8, when he attempted a flanking movement by attacking the Dujailar redoubt at the S. end of the Es Sinn position. On April 4 the Hannah position was carried, by which time the Felahieh position had been won.

Townshend was in serious need of food and supplies, and great efforts were made by the relieving force. On April 17 the British achieved a small success at Beit Aiessa, but the Es Sinn positions could be neither turned nor carried. On April 24 a desperate effort was made to break the blockade of Kut, and get supplies to Townshend. The steamer Julnar reached Magasis, behind Es Sinn, where it was captured by the Turks. Townshend surrendered on April 25, but the Turks failed to follow up their success, and the situation developed into a stalemate until autumn. *Consult My Campaign in Mesopotamia, C. Townshend, 1920.*

Esslingen. Town of Germany, in Württemberg. It stands on the Neckar, 7 m. E.S.E. of Stuttgart. Its chief interest is historical. The old town, around which are the modern suburbs, is still girt with its walls and towers, while above is the ruined castle. The public buildings include the church of S. Dionysius, dating in part from the 11th century; the 14th century church of Our Lady, a Gothic building restored in the 19th century, and containing some beautiful stained glass and a fine tower; the 13th century Gothic church of S. Paul; a hospital, and several schools. There are two town halls: the older one, dating from 1430, is now a school, and has a wonderful clock; the newer one was formerly

a palace. The industries include large engineering works, railway shops, electrical, textile, leather, toy, and furniture factories and a trade in wine. Esslingen, a town since 886, was a free city from 1209 until 1803, when it was taken into Württemberg. Pop. 43,089.

Est, CANAL DEL'. Canal of N.E. France. It extends from the Meuse, near Givet in Ardennes, to Portesur-Saône in Haute-Saône, and has connexion with the Marne and Rhône Canal at Void. Portions of the Meuse and Moselle are included in the canal system, which has a length of 286 m.

Estaires. Town of France, in the dept. of Nord. It is on the river Lys, 13 m. W. of Lille, and was prominent in the First Great War. The Allies occupied it early in Oct., 1914, and in the German offensive against the Channel ports of April, 1918, it was the scene of spirited fighting. At the Estaires drawbridge the British held the enemy until the great steel and concrete structure was blown up. Occupied by the Germans, April 11, it was recovered by the Allies early in Sept. *See Ypres, Battles of.*

Estate. Originally a condition, or rank, the idea expressed by the modern word state. It is chiefly used, however, for landed and other property, and all property is by English law classed as either real estate or personal estate. By the word alone is meant landed property, generally a considerable amount under a single ownership and all contiguous. An estate may be of various kinds, freehold, leasehold, or (until 1926) copyhold. *See Land Laws; Real Property.*

Estate Agent. One who acts for another in the management or sale of landed or house property. He lets and collects the rents of estates, farms, houses, cottages, etc., and generally represents the landlord in dealing with tenants. He should have a knowledge of agriculture, bookkeeping, surveying, valuing, forestry, drainage, building construction and repair, and the laws concerning the relations of landlord and tenant.

Estate Duties. Name given in the United Kingdom to the duties paid on the estates of deceased persons. They date from 1894,

before which time there were death duties of various kinds, including legacy, probate, and succession



Esslingen. Historic town of Württemberg. Gothic church of Our Lady, left, and the Town church, right

duties. In 1894 two new principles were introduced. Real property, hitherto exempt from charges of this kind, was made to pay at the same rate as personal property, and the duties were levied on a graduated scale. This scale varied from 1 p.c. on estates between £100 and £500 to 8 p.c. on estates over £1,000,000. From 1894 until 1946 the rates rose rapidly. The Finance Act, 1946, while increasing still further the rate on estates over £12,500, followed a new policy by exempting all estates not over £2,000 and reducing the rates on estates up to £12,500. The Finance Act, 1949, which abolished legacy and succession duty, left the rates of estate duty unchanged on estates under £17,500, but increased the rates on estates over that amount up to 80 per cent on estates over £1,000,000.

Estates. Word used for "an organized collection, made by representation or otherwise, of the several orders, states, or conditions of men who are recognized as possessing political power." Its interest is now solely historical, although we still speak of the estates of the realm. In France Germany, and some other European countries the same idea is translated by the word states, and so we have the states-general of France and the Dutch Republic.

The idea of estates began about the 13th century with the growth of the representative system, and they are found in Spain and France, as well as in England and Scotland. In France the various provinces, e.g. Brittany and Languedoc, had their local estates, and in Spain the various kingdoms had theirs. The German countries had also their estates who met in a landtag or diet. It is usual to assume

the number of estates as three, but this is purely accidental. In Sweden and Aragon there were four estates. In England the merchants and lawyers might easily have formed a separate estate, but they did not, and so we have the three estates of lords spiritual, lords temporal, and commons, sitting, however, in two houses. In Scotland the lesser barons formed a separate estate, not sitting, as they did in England, with the representatives of the towns. The sovereign is sometimes referred to as an estate of the realm, and the press is known, a tribute to its power, as the fourth estate, a phrase said to be due to Burke. *See* Diet; Landtag; Parliament; Representation.

Estcourt. Town and district of Natal. The town stands at an elevation of 3,830 ft., on the rly. from Pietermaritzburg to Ladysmith, 76 m. N.W. of the former. It was the scene of important operations during the S. African War. At Weenen, 28 m. N.E., parties of Boers were massacred by Zulus in 1838. Pop. (est.) town, 9,000.

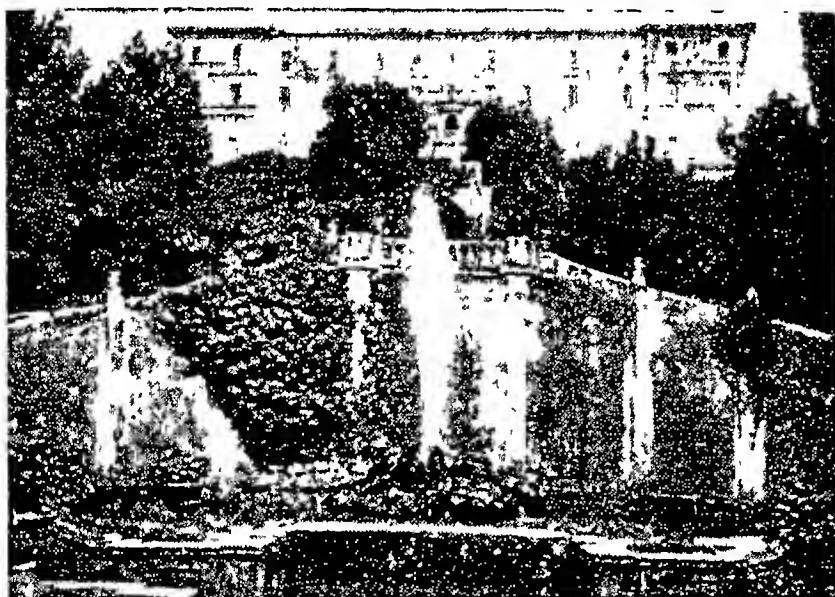
Este (anc. Ateste). A city of Italy, in the prov. of Padua. It stands on the slopes of the Euganean Hills, 20 m. by rly. S.W. of Padua. It is enclosed by medieval walls, has a ruined castle, a cathedral, and two other churches, one with a leaning bell-tower. The National Museum is rich in prehistoric, lacustrine, and sepulchral relics, besides Greco-Roman antiquities. The manufactures include pottery, ropes, and iron goods. A Roman town, it became the seat of the Este family in the 10th century, and in 1405 it surrendered to Venice. Pop. (1951) 16,101.

Este. Name of a noble Italian family founded by Oberto II (c. 1015), margrave of Casalmaggiore. His grandson, Azzo II, became duke of Milan, and his sons, Guelph and Fulco, founded the German and Italian branches of the family respectively. From the former the Hanoverian sovereigns of Great Britain are descended.

From the latter came the Italian family which held the lordships of Ferrara, Modena, and Reggio, the emperor Frederick III making Barco d'Este (d. 1471) duke of Modena and Reggio in 1452, and Pope Paul II creating him duke of Ferrara in 1471. His brother, Ercole I (1431-1505), was father of Beatrice

(1475-97), duchess of Milan, one of the most beautiful women of the Italian renaissance.

Alfonso I (1486-1534), who married Lucrezia Borgia as his second wife, he being her third husband, was a statesman and a soldier. His son, Cardinal Ippolito (1509-72), built the magnificent Villa d'Este at Tivoli (the whole upper storey of which, on one side of the courtyard, was demolished by a bomb dropped from an Allied aeroplane in 1944). Alfonso II (1533-97) kept a luxurious court, where he detained the poet Tasso, who was in love with his sister Eleanora. Alfonso IV (1634-62) was father of Maria Beatrice, queen of James II of England. The Italian branch of the family ended with Ercole III (1727-1803), who was dispossessed of the duchy of Modena by the treaty of Campoformio in 1797, and whose only daughter, Maria Beatrice, married



Este. The Villa d'Este at Tivoli, near Rome, built by Cardinal Ippolito d'Este in 1549

Archduke Ferdinand, third son of Francis I of Austria. His son Francis IV (1779-1846) was made duke of Modena by the congress of Vienna in 1814, but his son Francis V (1819-75) was dispossessed by the incorporation of the duchy in the kingdom of Italy in 1859. *See* Modena. *Pron.* Es-ty.

Ester. Substance formed by the union of alcohols and acids with the elimination of water. Gmelin first used the term ester to distinguish this class of compounds from simple and mixed "ethers." An ether is an oxide of the alcohol radical analogous to metallic oxides, whereas in esters both an alcohol radical and an acid radical are present. Esters are prepared (1) by the direct action of an acid upon an alcohol; (2) by the action of an acid chloride or the anhydride of an acid upon an alcohol; or (3) by treating the salt of an acid with an alkyl halide, e.g. methyl acetate may be prepared by treating silver acetate with methyl iodide. The esters are usually

neutral and colourless substances with a fragrant smell. Many occur in plants, forming the constituent to which the scent is due. They are sometimes manufactured as substitutes for natural perfumes and flavours.

Esterhazy, MARIE CHARLES FERDINAND WALSIN, COUNT (1847-1923). French soldier. He served in the regiment of Papal Zouaves, became a major in the French army, and accused Captain Dreyfus of writing the famous *bordereau*. or document, containing



Count Esterhazy, French soldier

military secrets, said to have been communicated to the German military authorities. The opinion grew that Esterhazy had himself forged the *bordereau* in an imitation of Dreyfus's handwriting, and that he had supplied information to Germany. He was compelled to leave France when the truth became known, and later confessed the forgery. He died in England. *See* Dreyfus Case.

Esterhazy de Galantha. Family of Hungarian noblemen. Dating back to the early 13th century, in the 17th they became princes of the German empire. They were prominent supporters of the house of Hapsburg and have included several notable men. Among these were Paul IV (1635-1713), a leading general in the wars against the Turks; Nikolaus Joseph (1714-90), general, diplomatist, and a patron of art, literature, and music; and Nikolaus IV (1765-1833), founder of a famous collection of pictures at Vienna, who declined Napoleon's offer of the crown of Hungary, and supported the national Hungarian movement.

Estevan. Town in the extreme S. of Saskatchewan, Canada. On the Souris river, it is 145 m. S.E. of Moosejaw by C.N.R. and C.P.R. The centre of a farming and coalmining district, it has grain elevators, a creamery, a flour mill and a plant making coal briquettes. Pop. (1951) 3,933.

Esther, BOOK OF. O.T. book so named after the chief character in the story. When Vashti, the consort of the Persian king Ahasuerus (Xerxes), was deposed, Esther, the adopted daughter of Mordecai, a Jewish exile, was chosen in her place. She was thus enabled to frustrate the plots of

Haman (*q.v.*), a powerful enemy of her people. Haman had cast lots (*purim*) to destroy the Jews, and the real purpose of the book seems to be to explain the origin of the Jewish festival Purim (called in 2 Maccabees, 15, *v.* 36, the Day of Mordecai). The book of Esther would seem to have been written between 300 B.C. and the Christian era.

Estimate. Statement in which is given the anticipated cost or price of specified work. The statement is prepared by the contractor who offers to carry out the work, and submitted for consideration to the person for whom the work is to be undertaken. Estimates are frequently given by builders, painters, or contractors for projected repairs on a relatively small scale. They do not form a legal contract, although in practice the price charged when the work is completed is usually that stated in the estimate. For more extensive operations, tenders setting out the work in detail and often specifying the quality of materials to be used, are prepared; the tender accepted is usually embodied in a legal contract.

Estimates of national expenditure are submitted annually before the end of March by various government depts. for consideration by parliament. They give the anticipated expenditure of the depts. during the financial year beginning April. Civil depts. submit their estimates through the Treasury, by which they are carefully considered and often adjusted before reaching parliament; but defence depts. submit their estimates without the intervention of the Treasury. Parliamentary control over national expenditure is thus safeguarded and the presentation before the budget speech early in April affords an opportunity for amendment, if necessary, before the inclusion of the estimates in the budget itself.

Civil expenditure is set out under the following headings: central government and finance; foreign and imperial services; justice, police, and prisons; education; health, labour, and insurance; trade and industry, including agriculture and fisheries, roads, and civil aviation; common services, which covers the expenses of the ministry of Works; war pensions; block grants to local authorities; and the expenditure of the ministries of Supply, Food, Transport, etc. Separate headings

show the cost of administering the inland revenue and customs and excise depts. and the post office.

Estoile (old Fr., star). In heraldry, a star, usually represented as having wavy rays. If there are six rays or more, only the alternate rays are wavy. An estoile with a number of long rays springing from it at an angle, or with a long tail, is called a comet. See Mullet.

Eston. Urban district of the North Riding of Yorkshire, England. It is 5 m. E. of Middlesbrough by railway. It has iron and steel works, a shipbuilding yard, and commercial docks. A big chemical works lies immediately to the E. of the urban district. Pop. (1951) 33,315.

Estonia. Soviet Socialist republic, part of the U.S.S.R. It is bounded N. by the Gulf of Finland, E. by the Leningrad region of R.S.F.S.R., S. by Latvia and Gulf of Riga, and W. by the Baltic. Its area is 18,353 sq. m. and in

industry. Dairy farming prospers and butter is the leading export. Oil-shale of high quality is plentiful. Manufactures include iron, steel, machinery, cement, cotton, paper, wood pulp, and spirits. Estonia carries on a large transit trade, the seaport of which is Tallinn, the capital, connected by railway with Leningrad. Other towns are Narva and Tartu (*q.v.*). Arensburg and Haapsalu are famed for their curative mud baths.

In religion the Estonians are Lutherans, except about 15 p.c. who belong to the Greek Orthodox Church. The standard of education is high, with few illiterates. Secondary education is provided by numerous grammar schools and lyceums. Tartu (Dorpat) university, established by Gustavus Adolphus in 1632, was reopened in 1919 as an Estonian university. Its technical faculty was made an independent university at Tallinn in 1936. Estonia is rich in folklore, the



Estonia. Map of the Baltic state which in 1940 became the 16th Soviet republic 1954 its estimated pop. was 1,200,000.

Except in the S.E., which is hilly, the mainland lies low; it is intersected by rivers and streams, and much of it is swampy. The rivers are rapid and not easily navigable. There are many lakes, and about half of Lake Peipus lies within it. About 21 p.c. is forest. The climate is warm in summer and cold in winter. Hiiumaa (Dagö), Saare (Oesel) and other islands in the Baltic belong to Estonia.

Agriculture, which is the chief occupation, is conducted scientifically, with the result that good crops, particularly flax, are raised from a naturally poor soil, and there is a flourishing livestock

chief records of which are *Monumenta Estoniae Antiquae*, and the MS. collection of Jacob Hurt, containing songs, tales, proverbs, and other folklore items. After F. R. Kreutzwald published the national epic *Kalevipoeg* in 1861, a new Estonian literature developed in the 19th century, the best-known writers being Otto Masing, Lydia Koldula, Mihkel Weski, and Johan Liiw.

HISTORY. The early history of the country is obscure, but early in the 13th century it was conquered by Danes and Germans. The Danes founded Reval (Tallinn) in 1219, and later divided the land between themselves and the Germans, finally selling their

part of it in 1346 to the Teutonic Knights who joined it up with Livonia. After the dissolution of the Teutonic Order in 1560, N. Estonia passed to Sweden. S. Estonia remained under Poland till 1629, when the whole of Estonia became a Swedish province with Livonia, which was ceded to Russia in 1721. German influence was always strong owing to the presence of the Baltic Barons, the descendants of the Teutonic Knights, and of numerous German settlers (Balts), who called the country *Estland* or *Esthland* and its natives the *Ests*. Only after the Russian revolution and the Estonian war of liberation was this dominant German influence crushed.

By decree of the Russian provisional government on April 12, 1917, the prov. of Estonia was united with the N. part of the prov. of Livonia and formed into a new autonomous prov. under a national council or diet. This council was elected by universal suffrage. After the seizure of the supreme power in Russia by Lenin, Estonia, like Finland, decided to become independent. She was about to hold a constituent assembly when the Bolsheviks intervened, and summarily dissolved the national council. During the Brest-Litovsk negotiations, the Germans, to compel Lenin to come to terms, took Tallinn, Feb. 25, 1918, and, marching through Estonia and Livonia, captured Dvinsk and Pskov.

After the Brest-Litovsk Treaty

By the Brest-Litovsk treaty the Bolsheviks undertook to evacuate those territories, which were to be policed by the Germans until the state organization of both provinces was restored. As this would have virtually meant the complete Germanisation of these regions, the people, 90 p.c. of whom were pure Estonians, made emphatic protests to the Allies, and Great Britain, France, and Italy recognized their national council. But the Germans remained masters of the country, and it was not till Nov. 11 that the Estonians recovered power. Next the Bolsheviks began an invasion which carried them to within 15 m. of Tallinn. Finland came to the aid of Estonia with 5,000 rifles, and on Dec. 12 a British fleet entered the capital in support with arms and munitions. Meanwhile Estonia had organized her army under a former Russian staff officer, and by Feb. 24, 1919, her soil was free of the invaders.

Longing for peace, the new state accepted proposals for a conference made by the Soviet government. This took place at Pskov on Sept. 19, but the Estonian delegates made it a condition that Bolshevik peace proposals were to be submitted to all the Baltic states together, to which the Soviet representatives agreed. After difficult and interrupted negotiations, peace was finally made Feb. 2, 1920, the independence of Estonia being recognized by the Soviet government.

Russia's Demand for Bases

In the autumn of 1939 Russia made demands on Estonia for naval and air bases, and on Sept. 28 the two states signed a mutual assistance pact. Russian aeroplanes, warships, and troops occupied strategic points on Oesel and Dagö and in the town of Baltiski. In June, 1940, Russia demanded a change of government and free passage for Soviet troops; and in Aug. Estonia became the 16th Soviet republic.

When Germany attacked Russia in June, 1941, one thrust was made through Lithuania, Latvia, and Estonia to Leningrad. German forces advanced on both sides of Lake Peipus to cut off the Russians in Estonia and directly threaten Leningrad. Tallinn was evacuated at the end of August, leaving Estonia, apart from Oesel, in German occupation. In 1944 Russian armies began to exert heavy pressure against the Germans in Estonia, reaching Lake Peipus and the Narva river early in Feb. Tallinn was liberated on Sept. 22 and Pernau the following day. By Sept. 29, Estonia had been freed from the invaders, except the islands of Dagö, freed Oct. 3, and Oesel, cleared of the enemy Nov. 24. *Consult* Estonia, J. A. Jackson, 1941.

Estoppel (old Fr. *estoper*, late Lat. *stuppeare*, to stuff with tow, *stuppa*). Doctrine of English law. Broadly, it means that in certain circumstances a party will not be allowed to show the truth in his own favour, when he has, by some act or deed or negligence, led the other party to believe that something else is the truth. Estoppel is (1) by deed; (2) *in pais*, or by act; (3) by negligence. (1) If A makes a deed of conveyance of Whiteacre to B on March 1, reciting in it that he (A) is the owner, and in fact he is not, but on some subsequent day he becomes the owner, the estate at once passes to B, because A will not be allowed to come and say that on March 1 he had no right to con-

vey. Generally speaking, every statement made by a man in a deed estops him from denying the truth of it. (2) If A does an act or makes a statement which causes B to alter his position, A is not allowed afterwards to aver against B anything to contradict the act or statement. Thus, if A takes lease of a house from B, he cannot afterwards say that B is not the owner thereof and refuse to pay his rent. (3) If A by his negligence causes B to alter his position, he is not allowed to dispute the correctness of B's action so as to take advantage of his own negligence.

Estournelles de Constant, PAUL HENRI BENJAMIN, BARON D' (1852-1924). French politician. He was born at La Flèche, Sarthe, Nov. 22, 1852. Councillor of the French embassy in London, 1890-95, then deputy for Sarthe until 1904, he represented France at The Hague peace conferences of 1899 and 1907. A member of the international court of arbitration, 1909, he received the Nobel peace prize the same year. After the First Great War he was appointed director-general of the French museums and art galleries, and strove for a Franco-German democratic rapprochement. He published a number of books on European and general peace problems. He died at Bordeaux, May 15, 1924.

Estovers or **BOTES**. Certain furnishings of wood that a tenant is allowed to cut and use for the purpose of his holding. They include *firebote*, or wood for firing; *ploughbote*, to mend his plough; *housebote*, to repair his house; and *hedgebote*, to maintain his fences. Estovers are usually, if not always, enforceable by the custom of a manor, and are rights indefeasibly attached to the lands that form part of that manor; that is to say, they are not personal rights, but must be claimed in the character of holder of the lands. Estovers is old Fr., necessities; *bote* is mid. Eng., advantage. *See* Lopping.

Estray (old Fr. *estraiier*, to stray, wander from the street, Lat. *strata*). Term used in law for a strayed animal. An ancient law of England says that if valuable tame animals are found wandering at large they are to belong to the sovereign. But in most cases the sovereign long ago granted the right in them to the lord of the manor where they might be found. They must be "proclaimed" in the nearest church and two market towns, and, if not claimed in a year and a day, are irredeemably lost to the owner. *See* Pound.

Estreat (old Fr. *estrait*, extract). Term used in English law, meaning to forfeit something, generally a sum of money, by way of enforcing an obligation to the crown. It usually occurs in the case of recognizances, where a person has agreed to do or not to do something in face of a court under penalty of paying so much if he does not fulfil the obligation. Thus, A. B. will enter into a recognizance to keep the peace for six months under penalty of £50. If he breaks the peace within that time his recognizance may be estreated, and the like happens if X. Y. goes bail in £50 that A. B. should appear and stand his trial. The bail will be estreated if A. B. does not duly appear. Estreat is enforced by levying a distress upon the property of the person liable. The original meaning of the word is a copy or extract of an original record or document.

Estrées, GABRIELLE D' (1573-99). Mistress of Henry IV of France. Daughter of Marquis Antoine d'Estrées, she met Henry at Coeuvres in 1590. Impressed by her beauty, the king caused her to be divorced from her husband, Nicholas d'Amerval, Sieur de Liancourt, and in 1592 he fetched her to Paris, where she bore him several children. He created her marquise de Monceaux and duchesse de Beaufort, and was so infatuated that, had she not died suddenly at Paris, April 10, 1599, he would have divorced Marguerite de Valois and made her his queen. *Consult Life* (in French), A. Desclozeaux, 1889. *Pron.* Estray.

Estrella, SERRA DA. Range of mountains of Portugal, in the prov. of Beira. Lying midway between the Tagus and the Douro rivers, virtually forming the watershed between the Mondego and the Zézere, it reaches its highest point in Malhão, 6,540 ft. A verdure-clad range, it commands extensive views, and runs, from S.W. to N.E., a distance of 75 m.

Estremadura. Province of W. Portugal, S. of Ribatejo (part of Estremadura until 1933). It is divided into the districts of Lisbon and Setubal. Its coastline is broken by the estuaries of the Tagus and the Sado rivers. N. of the Tagus it is hilly; to the S. it is low-lying with marshy land. Some parts are fertile, others barren; barely half is under cultivation. In the Tagus valley wine, oil, and fruit are produced. The manufactures are of little importance, but cork, salt, soda, and fish are exported, and herbs are grown

on the sandy plains. Area, 2,064 sq. m. Pop. 1,400,000.

Estremadura OR EXTREMA-DURA. Territorial division of S.W. Spain, co-extensive with the provinces of Cáceres and Badajoz. An arid plateau, denuded of its forests, lacking water, and depopulated by emigration to S. America, it is largely barren, heath-covered waste or undulating pastureland, feeding huge droves of migratory sheep and pigs. Principal rivers are the Tagus and Guadiana. The soil is naturally fertile, but agriculture is hindered by drought and locusts. Wine, olive oil, cork, figs, and almonds are produced, and oak and chestnut woods afford food for swine. Minerals exist but mining is backward. There was heavy fighting on the Estremadura front late in 1938 at the end of the civil war. Area 16,054 sq. m. Pop. 1,303,784.

Estuarine Deposits. Accumulations of sediment transported by a river and laid down near its mouth. They depend on grade of sediment, strength of current, and depth of river. Frequently the dropping of sediment, caused by the checking of the stream by the sea, forms a barrier across the mouth, and lagoon conditions are established inside. In former geological periods such conditions have resulted in deposits marked by comparatively limited extent, usually sandy facies, and accompanied by characteristic vegetation and animal remains (shellfish, etc.), e.g. inferior oolite beds of Yorkshire.

Estuary (Lat. *aestus*, tide). Arm of the sea into which a river flows. As a rule an estuary consists of the drowned lower portion of a valley. Where the land slopes gently down below sea level and the shores are wider apart nearer the open sea the estuary is a *ria*, or drowned river valley; the indentations of S.W. Ireland belong to this type. The indentations of the Norwegian coast, the fjords, are steep-sided, deep estuaries which are shallow near the entrance; they are due in part to glacier action. On some coasts estuaries arise from the emergence above the water of sand banks, which transform a bay into a lagoon filled with river water. Such estuaries are the *haffs* of the S. shores of the Baltic. British estuaries are notably more extensive than the rivers which now flow into them; thus inconformity indicates submergence. Estuaries tend to be filled up with alluvium, the Dee estuary being

thus almost useless for navigation. *See* Coast; River.

Esutoru. Japanese name of a town and port of southern Sakhalin. It lies on the west coast, about 250 m. N. of La Perouse Strait, and some 75 m. W. of the mainland of Asiatic Russia. In the vicinity are important coalmines, and after southern Sakhalin was occupied by Russia in 1945 the name of Esutoru was changed to Uglegorsk (meaning coal mountain).

Eszék. Hungarian form of the name of the Yugoslav town of Osijek (*q.v.*), lying 100 m. N.W. of Belgrade.

Esztergom (Ger. Gran). City of Hungary, on the right bank of the Danube, 38 m. by rly. N.W. of Budapest. It is the eccles. capital, having been the birthplace of S. Stephen, king of Hungary. The cathedral (1821-70) was said to be the finest building of its kind in Hungary. The centre of an agricultural and vine-growing district, it is noted for its thermal springs. Below the town the Danube flows in a contracted valley and makes its great bend to the south.

At Esztergom was the river bridge for road traffic from Budapest to the Little Alföld. In the Second Great War it was entered by Marshal Tolbukhin's forces on Dec. 26, 1944, during the Russian offensive resulting in the investment of Budapest. The Germans made desperate efforts to relieve Budapest, and the Russians were compelled to evacuate Esztergom on Jan. 7, 1945. They did not retake it until March 25. Pop. 17,360.

Etah. District and town in India, in the Agra division of the Uttar Union. The area of the district is 1,719 sq. m. Sixty p.c. of the land is cultivated, among the chief crops being wheat, barley, maize, grain, cotton, sugar-cane, and indigo. The headquarters of the district are situated in the town of Etah, which dates from the 14th century. Pop. of dist., 984,760.

Etah. Settlement on the coast of Greenland. In Prudhoe Land on Smith Sound, it is inhabited by Eskimos.

Étampes. Town of France, in the dept. of Seine-et-Oise. It stands on the Juine, 38 m. by rly. S.S.W. of Paris, and has a number of small industries, including flour-milling, but is chiefly a market for agricultural produce. In the Middle Ages it was comparatively more important, and its old buildings included the churches of Notre Dame, S. Basil, S. Gilles, and S. Martin;

and the 16th century hôtel de ville. Francis I made one of his mistresses duchess of Étampes. Here also was a house once occupied by Diana of Poitiers. Pop. (1954) 11,890.

Etana. In ancient Mesopotamian legend, a mythical shepherd king of Kish who reigned after the great Flood for 1,500 years, and ascended to heaven on the back of an eagle in order to obtain the talisman of birth which should ensure him a successor.

Étang (Lat. *stagnum*). French word for a shallow, almost stagnant, briny sheet of water somewhat similar to a lagoon. These are frequent in the S.W. part of France, bordering the Bay of Biscay. One of the largest is the Étang de Berre (*q.v.*), in the dept. of Bouches-du-Rhône.

Étaples. Town of France, in the dept. of Pas-de-Calais. It stands on the estuary of the Canche, 17 m. S. of Boulogne, and near the coast. It is the railway terminus for Paris-Plage, and is a fishing centre. In early days it was a flourishing port, and here, in 1492, England and France made a treaty. The First Great War created a temporary Étaples of wider dimensions, as an important British military base and training station. It expanded N. along the main road to Boulogne, a city of hospitals in that direction. On May 19, 1918, the Germans made a night air raid on its hospitals, causing about 300 casualties. The British war cemetery on the Camiers road, visible from the main Boulogne-Paris rly., contains 11,000 graves. See Cemetery plate, facing p. 1889. In the Second Great War Étaples was captured by the Germans during their rapid advance on Boulogne, which they entered on May 23, 1940. The town was liberated by units of the 1st Canadian army on Sept. 4, 1944.

Etawah. District and town of India, in the Allahabad division of the Uttar Union. The district has an area of 1,669 sq. m. Fifty p.c. of it is under cultivation, the chief crops being wheat, gram, millet, and barley; cotton is also grown. Etawah town is on the Jumna and on the East Indian rly., 60 m. S.E. of Agra. It contains a mosque and a number of Hindu temples. Trade consists largely in ghi, gram, cotton, and oilseeds. Pop. (1951) district, 970,695; town, 59,986.

Etching (Ger. *ätzen*, to corrode). Method of engraving on metal either by biting with an acid a

design drawn through a ground specially laid on the metal, or by drawing with a needle directly on the metal. Of several metals used for this purpose, among them iron, zinc, and pewter, copper is by far the most common.

In etching by acid, the plate is covered with a coating of wax or other resinous substance, and to this ground are transferred the details of a drawing by laying upon it the paper upon which the design has already been made in black pencil or red chalk and

posed long enough to complete the erosion. The duration of the bath will depend upon the elaborateness of the drawing.

Soft ground etching resembles pencil drawing or lithography in its final result. The etching ground is made by mixing ordinary etching ground with about half its weight in tallow or other fat. It is laid upon the plate and blackened with smoke as for ordinary etching. A piece of thin paper is then strained over the surface of the plate, and upon this the draw-



Etching. Rembrandt with the Sabre: reproduction in half-tone of an etching by Rembrandt, dated 1634. Only four first impressions of this exist

passing it through a hand press. The drawing is then traced with a steel needle through the wax down and into the copper, and when it is finished the plate is submitted to the action of nitric or other acid. The parts that are to come light and sketchy are exposed for a certain time to the mordant and then "stopped out" with a suitable varnish to prevent further action of the acid in these passages; the parts which contain more work and are to be darker are exposed for a further period, and when sufficiently eaten are, in turn, stopped out; the parts which contain the heavy shadows and blacks are then ex-

ing is made with a lead pencil. The back of the paper, where the pencil point has travelled over its surface, sticks to the ground, and when the paper is removed part of the ground comes with it, leaving the lines that have been drawn marked on the ground with a grain corresponding to the grain of the paper used.

In the dry-point method of etching, the artist draws his subject with a hard, sharp steel point upon a perfectly clean, unscratched, flawless copper plate. Dry point was also employed to some extent to define the general features of a drawing that was to be finally treated by the method of line

engraving, and, on the other hand, the graver was occasionally borrowed to open up work or strengthen an effect which the unaided needle could not satisfactorily accomplish.

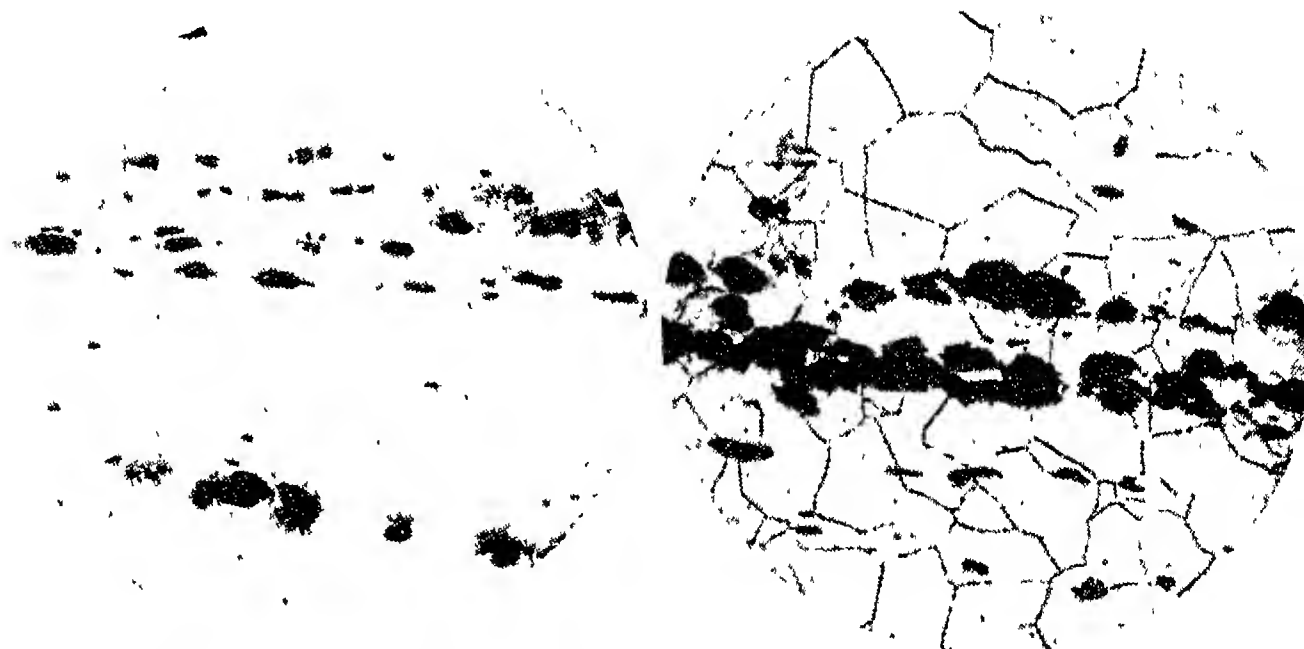
Etching dates from the time of Albert Dürer (1471–1528), who dry-pointed several plates in 1512 and 1518, but found it an unsympathetic medium, and abandoned etching in favour of engraving. Iron, the metal used in early experiments, did not lend itself to subtle or delicate effects. Van Dyck's instinct for form led him to what is now regarded as the secret of etching—economy of line, and dramatic contrasts in force and precision. No practitioner, however, has ever rivalled the productions of Rembrandt. His plates reveal broad yet drastic treatment; some of the finest examples include the *Ecce Homo*, and the *Three Crosses*. His landscape etchings stand apart as supreme examples of simplicity in their mastery of detail; in his numerous portraits he shows great variety of costume and character.

The greatest etcher in England during the 17th century was Hollar (1607–77), a native of Prague, who spent the greater part of his life in Britain. Of the Italians the most brilliant were Annibale Carracci, Barbieri, and Caletti, but greater was Ribera (1588–1652), a Spaniard who worked in Naples. Goya (1746–1828) stands supreme in the art of etching. In the *Caprichos*, *Proverbios*, and *Desastros de la Guerra*, he used aquatint (*q.v.*) for the backgrounds—a medium which instead of line deals with broad masses, and which was frequently used by English artists of the early 19th century to repro-

duce water-colour drawings. Goya repeatedly used an etched line as guide and basis for tonal work.

The revival of etching in England during the latter half of the

papers, decreasing successively in fineness, and polishing on cloth with fine abrasives. This leaves a smooth surface, free from scratches, similar to that shown in Fig. 1, a



Etching : preparation of specimens for microscopical examination. The same wrought iron unetched (Fig. 1, left) and etched (Fig. 2, right). $\times 120$

19th century was due to the influence of Whistler (1834–1903), F. Seymour Haden (1818–1910), and Legros (1837–1911). The tradition was carried on by a number of brilliant technicians, D. Y. Cameron (1865–1945), Muirhead Bone (1876–1953), William Strang (1858–1921), James McBey (b. 1883), Joseph Pennell (1860–1926), F. Brangwyn (1867–1956).

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Etching. A metallurgical process. Before a specimen sample of a metal can usefully be examined under a microscope, it must be carefully prepared. This involves rough shaping and grinding, fine grinding with emery

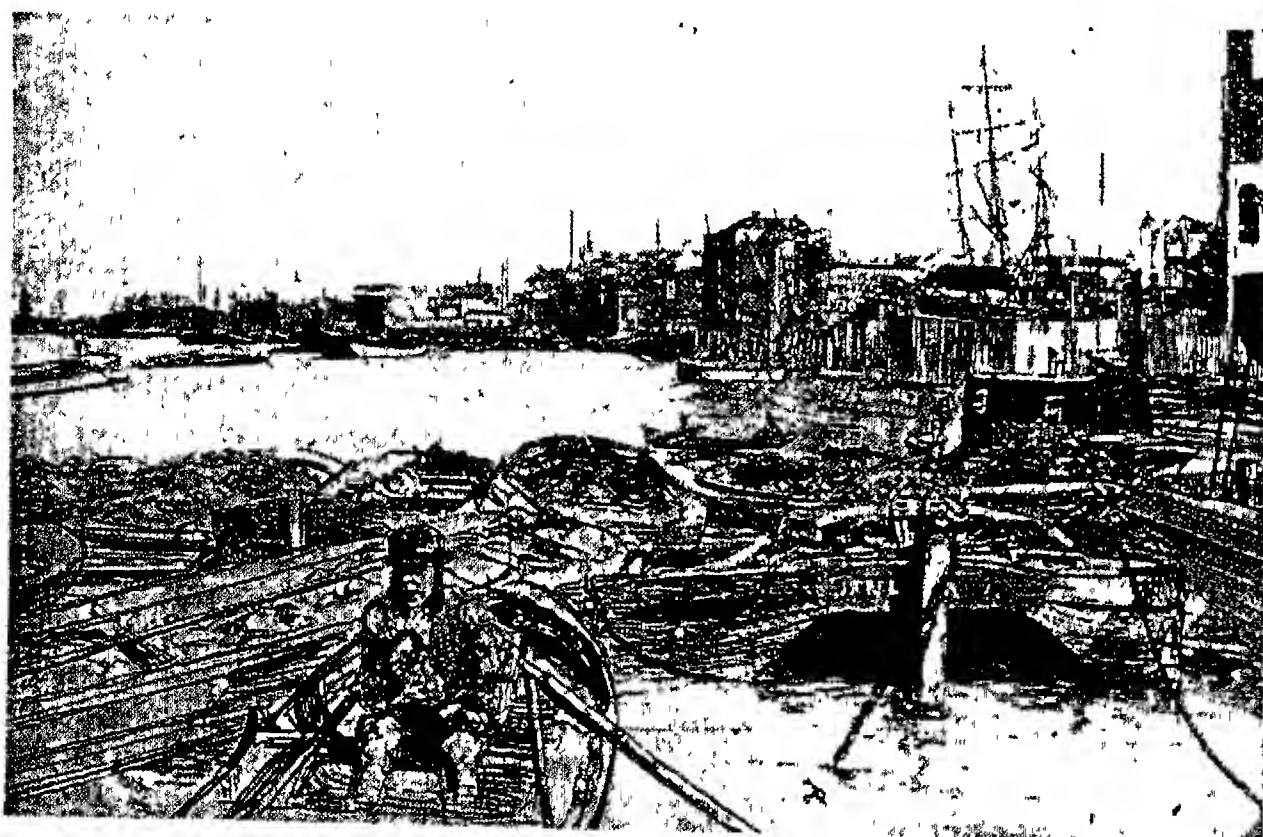
wrought iron. All that can be seen is a smooth surface with some patches of black slag, which have been forged into the iron. In order to see the crystalline structure of the metal beneath, the flowed, smooth surface must be removed by the action of acids or alkalis, or individual particles of varying composition must be revealed by differential staining. In Fig. 2, which is the same sample as before but etched in a 2 p.c. solution of nitric acid in alcohol, the boundaries of the crystals are clearly seen as dark lines separating the crystals themselves.

Etesian Winds (Gr. *etēsios*, yearly). The prevailing northerly winds blowing in summer in the Mediterranean region. They blow very strongly up the Nile valley, and are of great value to the dahabiyehs, to help them up the river against the current.

Ethandune. Name given to the great victory of Alfred of Wessex over the Danes under Guthrum in early May, 878, after which the Danes sued for peace, and Guthrum and a number of his followers accepted Christian baptism. Edington, Wilts, is suggested as the probable site.

Ethane. Colourless gas ($\text{CH}_3\text{—CH}_3$ or C_2H_6), boiling at -84°C . It is soluble in alcohol and nearly insoluble in water, and is prepared by the electrolysis of sodium or potassium acetate, or by passing a mixture of hydrogen and acetylene over finely divided nickel. It burns with a faintly luminous flame.

Ethel OR **ÆTHEL**. Anglo-Saxon word meaning noble. It is found as a prefix to many Anglo-Saxon names, *e.g.* Ethelfrith and Ethelfleda.



The Pool of London : half-tone reproduction of an etching by Whistler

Ethelbald. King of Wessex from 858 to 860. The second son of Ethelwulf, he assisted that king in the battle of Ockley against the Danes in 851. He married his stepmother, Judith, daughter of Charles the Bald. He was buried at Sherborne.

Ethelbert (c. 552-616). King of Kent, son of Eormenric, and a descendant of Hengist. He became king about 560 and was defeated by the W. Saxons, 568. In 597 his over-lordship is said to have extended over all the English kings as far N. as the Humber. His wife was a Christian—Bertha, daughter of the Frank king of Paris, Charibert—and in 597 Ethelbert was baptized by S. Augustine. He issued in 600 a code of laws known as dooms (*q.v.*), one of the earliest documents in English. He died Feb. 24, 616.

Another Ethelbert was king of Wessex and Kent. Third son of Ethelwulf, he succeeded his brother Ethelbald in 860 and had a difficult reign largely occupied with fighting against the Danes. He died in 866 and was buried at Sherborne.

Etheldreda, SAINT (c. 630-679). Abbess of Ely, often called S. Audrey. The third daughter of



Etheldreda. Her shrine in Ely cathedral to which place she was translated in 1106

King Anna of E. Anglia, she was born at Exning in Suffolk. Married first to Tonbert, an E. Anglian prince, secondly to King Egfrid of Northumbria, she shunned the married state and became a nun at Coldingham. About 672 she founded a nunnery on her own estate at Ely and died June 23, 679. Ely Cathedral marks the site of her grave, and the church in Ely Place, Holborn, is dedicated to her.

Ethelfleda (d. 918). Eldest daughter of Alfred the Great, known as the Lady of the Mercians. Brought up at Alfred's court, she married Ethelred, earl of Mercia.

After her husband's death, 911, she became sole ruler of Mercia, which she secured against attack by building numerous fortresses. In 916 she ended the incursions of the Welsh by taking Brecknock and capturing the king's wife. She died at Tamworth, June 12, 918, and was buried at Gloucester.

Ethelfrith (d. 617). King of Northumbria. He was the son of Ethelric, king of Bernicia, whom he succeeded about 593. He married the daughter of Ella, king of Deira, and drove out his son Edwin. In 603 he defeated the Scots at Daegsastan, and about 613 the Welsh at Chester. He was defeated on the banks of the Idle by Edwin's protector Raedwald, king of E. Anglia, and was slain in the battle.

Ethelred I (d. 871). King of Wessex and Kent. Son of Ethelwulf, king of Wessex, and elder brother of Alfred the Great, he succeeded his brother Ethelbert in 866. In his reign the northern kingdoms were in the hands of the Danes, against whom in 871 Ethelred and Alfred fought six battles, the most notable being the English victory at Assundune (?Ashdown). The white horse at Uffington, Berks, is traditionally supposed to commemorate this success. A pious ruler, Ethelred made a pilgrimage to Rome, possibly in the hope of averting the Danish peril, and died of wounds received in battle, April 23, 871. He was buried at Wimborne.

Ethelred II (c. 968-1016). King of the English. Son of Edgar by his second wife Aelfthryth, he was known as the Unready or the Redeless from his inability to discern good rede or counsel. He succeeded his stepbrother Edward the Martyr in 978 and was crowned by Dunstan at Kingston. In constant conflict with the Danes, he instituted the danegeld, for raising tribute to buy them off. The king seems to have been incompetent rather than vicious, but could be capable of cruelty, and in 1002 a general massacre of Danes was carried out on S. Brice's day, Nov. 12, by Ethelred's command. This led to further invasions, higher danegeld, and eventually to the recognition of Sweyn, king of Denmark, as king of England. Ethelred fled to Normandy, 1014, but reigned again after Sweyn's death. His wife was Emma, daughter of Richard, duke of Normandy; and his son Edmund Ironside. He died April 23, 1016.

Ethelwulf (d. 858). King of Wessex. Son of Egbert and father of Alfred the Great. he succeeded

his father in 839, Athelstan being made king of Kent. The Danes wintered in England for the first time in his reign. In 851 he routed them at Aclea, perhaps Ockley. He went on pilgrimage to Rome in 855 with his son Alfred and brought back his second wife, Judith, daughter of Charles the Bald. On his return he made over Wessex to his son Ethelbald, who in his absence had seized Kent, which Ethelwulf retained for his own rule. He was buried at Winchester.

Ether (Gr. *aithēr*). In physics, according to the older theory, a tenuous, elastic medium supposed to permeate space and to fill the interstices between the particles in all forms of matter. By this theory the ether is considered to be the medium through which light waves and other electro-magnetic waves are propagated. In fact, the theoretical ether was invented to account for the wave propagation of light. The early, mechanical, theory was gradually abandoned after the publication of the electro-magnetic theory of light by James Clerk Maxwell in 1864 and the discovery of the Hertzian waves by H. R. Hertz in 1888. A number of variant explanations were then put forward having an electrical basis for the ether.

Experiments to determine the velocity of light brought incidental problems concerned with the existence of this subtle, elastic, all-pervading medium of propagation. In 1881 Michelson and Morley made the first historic experiment on these lines, with a negative result; later repetitions brought the same result, with the exception of one carried out by D. C. Miller in 1925 at Mt. Wilson Observatory. Briefly the aim of the experiments was to find out if the velocity of a light beam projected in the direction of the imagined ether stream—i.e. in the direction of the earth's motion—was the same as that of a light beam projected in a direction at right angles to that of the ether stream. The two beams were sent out and reflected back to the point of propagation; here, by means of an interferometer, any difference in the time of the journey to and fro would have been disclosed by an aberration—an optical effect—but, as stated, the result showed no such aberration in almost all the experiments. These experiments called in question the very existence of the theoretical ether.

In 1905 Albert Einstein published his special theory of relativity, and ten years later his

general theory. The failure of the Michelson-Morley experiments and similar later ones to show a difference in the velocities or propagation times of the two light beams sent out at right angles offered a confirmation of Einstein's theories, which dispensed with the ether and held that a light beam, whether sent out from a stationary system or a moving system, would have the same velocity. *See* Einstein, A.; Light; Michelson-Morley Experiment; Relativity.

Ether. In chemistry, the term denoting a large group of carbon compounds, the molecule of which contains an atom of oxygen attached to two groups such as CH_3 , C_2H_5 , C_3H_7 , etc. If the ether contains two similar groups it is called a simple ether; if it contains two different groups it is called

a mixed ether; thus $\text{O} \begin{array}{l} \nearrow \text{CH}_3 \\ \searrow \text{CH}_3 \end{array}$ (dimethyl ether) is a simple ether

but $\text{O} \begin{array}{l} \nearrow \text{CH}_3 \\ \searrow \text{C}_2\text{H}_5 \end{array}$ (methyl ethyl ether)

is a mixed ether. The ether well known as an anaesthetic is diethyl

ether $\text{O} \begin{array}{l} \nearrow \text{C}_2\text{H}_5 \\ \searrow \text{C}_2\text{H}_5 \end{array}$; it is a colourless

liquid boiling at 34.5°C . and has a characteristic smell; when used as an anaesthetic it is usually mixed with chloroform and alcohol; it is manufactured by cautiously heating a mixture of alcohol and sulphuric acid to a temperature of about 140°C .

In medicine, ether was much used as a digestive and cardiac stimulant, but today is less prescribed than other allied preparations. Ether evaporates rapidly, producing great cold, and a spray directed against the skin results in local anaesthesia permitting of the painless performance of certain surgical procedures. Its most valuable use is as a general anaesthetic, either alone or combined with chloroform. Though less directly dangerous than chloroform, it is an irritant to the respiratory passages and should not be used in cases where lung trouble might be expected to follow the anaesthetic.

Etherege, SIR GEORGE (1634-91). English dramatist. Of an Oxfordshire family, he studied law, but gave his time mainly to the life of a man of fashion. In 1664 his first comedy, *The Comical Revenge, or Love in a Tub*, was produced at the Duke's Theatre, and from that time its author's name and fame were assured. A second,

She Would if She Could, and then a third, *The Man of Mode*, followed, each a distinct success. *Etherege* was knighted, and in 1685 James II sent him to represent England at Ratisbon (Regensburg). From 1688 he lived mainly in Paris, where he died. *Etherege's* knowledge of the social life of his time was complete, and his portraiture of its gallants, ladies, and their surroundings perfect.

Ethical Movement. Movement for the culture of morality apart from theology. Its members profess freedom from all religious creeds and opposition to none. The movement began in the U.S.A.

ETHICS: THE SCIENCE OF MORALITY

Lord Lindsay of Birker. Master of Balliol College, Oxford 1924 49

Further information on philosophy, of which Ethics is a branch, will be found in the articles Metaphysics; Philosophy; Psychology. See also biographies of Aristotle; Green; Hegel; Kant; Plato, and other philosophers

Ethics is the inquiry into human conduct in so far as conduct is right or wrong, or has moral value. The term good is used to denote that which possesses such value, and thus ethics is sometimes described as consisting of an inquiry into the meaning of good. It is to be distinguished from anthropology or sociology, sciences which do not exclusively refer to moral values, being mainly descriptive or scientific, while ethics is essentially reflective or philosophic. "How is human life organized and carried on?" is the question of sociology and allied sciences. "What is the aim of human life, and what the chief end of man's activities?" is the question which ethics has to answer. Starting with men's moral judgements of right and wrong, of good and bad, it asks what they imply as to man's nature, in what relation they stand to scientific and aesthetic judgements, and how and in what sense they are objective.

Man's Choice of Action

The fundamental conception of ethics is that of value. It assumes that man is not an animal with certain fixed wants, whose different actions are merely different ways of satisfying the same fundamental needs, but that, over and above his simple physiological requirements, man has other wants, changeable and changing, between which he chooses. This act of choosing between different wants, or the preference of one satisfaction to another, is valuation.

From this valuation or appraisalment of wants must be distinguished the actual steps which have to be taken to satisfy these

wants, or the discovery of means towards the ends which man has approved. Generally speaking, this may be called the sphere of economic activity, whether technical, if occupied with the adaptation of the material world to man's peculiar wants, or economic in the strict sense, if occupied with men's relations so far as they will produce most efficiently what man wants. Economic activity, then, unlike ethics, takes for granted the end of man's efforts and deals solely with the means to attain that end. It is not immoral; simply non-moral.

Some have denied that this distinction between these aspects of human conduct exists. Naturalistic ethics tries to show that man's conduct can in all respects be explained by the working of certain evolutionary laws and forces. Behaviour, it is argued, has not changed owing to any change in the conception of the end to be attained, but, being directed always to the one end of the survival and continuance of the human species, has altered only with changes in human environment. Were this conception true, ethics would become only a part of biological science. Looking more closely, however, at the struggle for survival, it is plain that both degeneracy and progress have been produced. The survival of the fittest means strictly the struggle of the fittest to survive, and the judgement that the results of the process are some good and some bad, cannot be got from the process itself, but from ethical reflection upon it. Adaptation to environment must certainly be taken into account in a history of ethics,

but no less must ethics make allowance for those variations in the ultimate standard of life for which men are prepared to struggle. The attempt to explain history by assuming that men's aims are always the same will not fit the facts.

This distinction between technical activity and conduct was first elaborated in Greek moral philosophy. The ethics of Plato deal with the good of the individual, the good of society, and the relations existing between them. Thus, in *The Republic*, he sought chiefly to determine the nature of justice as such, and the means of attaining justice in the relations of men, *i.e.* in society. He showed that life could be regarded as divided between a number of skilled processes or arts.

Plato and Ethics

Conduct, however, was not one of these, but was concerned rather with the relations between the ends of all these human processes and the relation of these ends to life itself. All the arts and activities of life he regarded as subordinate to the one purpose of life as a whole, which he called the good. This idea of the good is at once the eternal object of all human speculation, and a practical ideal capable of human attainment, such as justice or temperance. Ethics, then, was an inquiry into the good which all men sought, but the nature of which none properly understood. Greek thought sometimes regarded the good as attainable by the harmonious adjustment of human desires to one another, making pleasure, or the satisfaction of the greatest possible number of desires, the *summum bonum*, or highest good. But Plato showed that such a harmony was impossible without the recognition that certain activities or wants of the soul were higher than others. Thus, though Plato still regarded ethics as a matter of knowledge, he made clear that knowledge of the good was different from skill and involved certain emotional elements, was not in fact purely a matter of reason.

Aristotle elaborated the distinction between knowledge and moral insight, dwelling especially on the nature of the deliberate choice or will of man in his search after the good life. Here he insisted that both emotional and intellectual elements must be recognized, and pointed out that in an art the end existed outside the means, calling therefore for knowledge, while in conduct the end lay within the act itself, a recognition of moral insight.

Greek moral philosophy, however, preoccupied with the notion of the supreme good, remained intellectualistic, as may be seen in its difficulty in explaining that outstanding fact in human conduct, moral conflict and the weakness of the will. Characteristic also was the Greek identification of ethics with politics. The relations of men with each other were conceived as analogous to those of the different desires within the individual, a manifold to be reconciled within the harmony or unity of the good life, that is, according to Aristotle, the complete exercise of man's rational functions which differentiate him from the rest of creation. Other important schools of Greek ethical thought were those of the Cyrenaics and Epicureans, who interpreted morality in hedonistic terms, and those of the Cynics and Stoics, who held rational virtue to be an end in itself.

In modern times the greatest influence has been the growth of the natural sciences with their view of nature as one deterministic system. This assumption made a sharp contrast with the Christian, and especially the Protestant, insistence on the absolute worth of the individual, and so has focussed ethical inquiry on the problem of the freedom of the will.

Immanuel Kant

The modern point of view is represented better by Immanuel Kant than by anyone else. He regarded the outstanding fact of conduct as the contrast between what *is* and what *ought to be*, and emphasised the impossibility of deriving the latter from the former. However much we may learn of the influence of heredity and environment upon human action, the statement that an action is wrong implies that it ought not to have been done, and therefore need not have been done. Here is the contrast with the deterministic conceptions of modern science. The possibility of alternatives of action is as fundamental for human conduct as determinism for the natural sciences.

How the two are to be reconciled is a matter for metaphysics. Ethics is content to show that conduct implies a definite principle of action, not inconsistent with man's heredity or environment, but different and underivable from such influences. The judgement of value, then, so closely bound up with conduct, is seen to tell us something about the nature of man.

How its underivable and immediate character is consistent with the change and development of ethical judgements in history; how ethical

progress takes place in the developed moral insight of individuals; how ethical progress finds expression in a system of social rights and obligations; how moral judgements imply something more than the mere results of human reasoning, and yet may have an objectivity different from, but as real as, that of scientific judgements—these are the questions with which ethics is concerned.

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Ethiopia OR AETHIOPIA (Gr. Aithiopia). In ancient geography, name given by the Greeks to the whole of Africa from the Red Sea to the Atlantic, in a narrower sense to the territory comprised in modern Nubia, Sennar, Kordofan, and part of Abyssinia. The name, derived from *aithein*, to burn, and *ōps*, face, was originally applied to all countries inhabited by persons dark-skinned as the result of the heat of the sun. In the Homeric poems the Ethiopians are described as dwelling on the uttermost confines of the earth, a pious and blameless people, often visited by the gods. According to Herodotus, they were straight-haired in the E., curly-haired in the W.

From the earliest times the history of the country was intimately connected with that of Egypt; caravans penetrated Nubia, or Kush, and brought back ivory, ebony, and slaves. The XIIth dynasty held Nubia to the 2nd cataract, and under the XVIIth dynasty Kush became an Egyptian province. The first Ethiopian kingdom was that of Napata, founded about the 11th century B.C. In the 5th century B.C. these kings ruled Egypt as the XXVth dynasty. Cambyses invaded the country in 524 B.C.; and c. 450 the capital was removed to Meroë, and a new kingdom arose chiefly ruled by princesses called by the title Candacē. The Romans made expeditions into the country, in one of which (24 B.C.) the Ethiopians suffered a severe defeat; but the conquered territory was abandoned by order of Augustus.

The name Ethiopia is also given to a Christian kingdom established in the Abyssinian highlands, the origin of the empire of Abyssinia, the official name of

which remains Ethiopia. The inhabitants, of Semitic origin, spoke a language called Geez, which showed greater affinities with the Arabic of the Sabaeans in S. Arabia than with classical Arabic. The alphabet was perhaps of Phoenician origin. There was an Ethiopic version of the Bible, including various apocryphal books added to both the O.T. and the N.T. Geez was superseded by Amharic as the official language, but continued to be used in the churches and in literature. It is now represented by two dialects, Tigre and Tigray. See Abyssinia.

Ethmoid Bone (Gr. *ēthmos*, strainer, sieve; *eidos*, form). Bone which projects downwards from the frontal bones of the head. It enters into the formation of the floor of the cranium, the orbits or eye-sockets, and the deeper parts



Ethmoid Bone. Left, front view of the bone; right, side view

of the nose. Roughly cuboid in shape, it is of a spongy, porous consistency, a very complicated structure, and contains a number of small cavities.

Ethnography (Gr. *ethnos*, nation; *graphein*, to write). Branch of ethnology (*v.i.*), which comprises the study and description of particular human social groups, in reference to their distinctive characteristics.

ETHNOLOGY: STUDY OF PEOPLES' LIVES

H. J. Fleure, D.Sc., F.R.S. Author of *The Negro and His Characteristics*

The different ways in which peoples in various parts of the world, and at varying stages of development, conduct their society are studied in ethnology. Cognate subjects are Anthropology; Family; Tribe. See also articles on American Indian; Celt; Slav; and other human groups

Ethnology is the science which studies the lives of the peoples. The modes of life among mankind have developed, with many diversifications, from a general original dependence on the collection of food—nuts, fruits, some leaves, probably small animals, honey, manna, shore animals, fish, etc. Hardly any peoples, if any at all, have remained at this primal stage. In the Old Stone Age, probably hundreds of thousands of years ago, man learned to stand erect and to preserve, if not at first to make, fire. With these advances he became a hunter, making pitfalls and later developing spears and arrows for action at a distance; the women and children and those unable to run with the hunters meanwhile went on collecting.

The surviving hunter-collectors include the Australian aborigines, some Bushmen of S.W. Africa, pigmies of the African equatorial forest, the people of the Andamans, forest people of a few spots in India, Malaya, and some of the islands off S.E. Asia. The Eskimo are functionally akin to these groups as are several groups of American Indians, but probably their case is more complex. This mode of life requires usually more than 1 sq. m. per person, and groups are typically small with little differentiation of rank or function, but with joint action

by a number of men who collectively resent intrusions of other groups into the territories over which they habitually range. Present day hunter-collectors are but lingering groups, usually in unfavourable environments (desert or damp hot forest), remnants of an old order that has nearly passed away, usually wandering considerably, though the Eskimo may make durable winter houses of stone and return to them, and some S.W. Africans have a group of huts arranged around a dancing floor or ceremonial space. There may be some council of heads of families, some scheme of initiation of, at any rate, the boys into the work of hunting, and into marriage, which may be polygynous if a man is prosperous enough. Customary taboos affect the choice of a wife and are often said to be aimed at avoidance of very close inbreeding, though this is not always very accurately secured.

In the Old Stone Age

The hunting-collecting mode of life was characteristic of the Old Stone Age, late in which, perhaps less than 100,000 years ago, desert areas increased in N. Africa and S.W. Asia, and peoples there were driven to the neighbourhoods of the Nile, Euphrates, etc., where the care of seed-yielding grasses (cereals) evolved among the women as a supplement to collecting—

here we have the basis of the story of Eve. Cultivation probably began before 5,000 B.C. Use of stone for hoeing brought forth the idea of rubbing stones to shape them, and soon of cracking them and softening some (metallic ores) in the fire. Thus a Neolithic, cultivating phase evolved as a preliminary to the dawn of metallurgy. Cultivation with the hoe, chiefly by women and enslaved men, was supplemented by spade cultivation, more particularly as work for men, and by ditch digging on the flood plains of the rivers as they became cleared of bush. Thus cultivation brought an increasingly settled life, and among the early cultivated plants were spelt-wheat, emmer-wheat, barley, millets, and probably some fleshy roots and bulbs as well as perhaps some beans.

To Africa south of the Sahara there spread the cultivation of millets, beans, and some roots, supplemented later by banana-growing, introduced from Asia, but few flood plains were available and cultivation has typically been in bush clearings which become exhausted after a few years and need time to recover. The group of cultivators resents the intrusion of other groups into an area it is using or is likely to use; and usually the elders, or a chief, may hold the land and give permission to members of the group to clear and use a patch, or a patch for each wife if the man has more than one. Individual or negotiable property in land is outside most African peoples' native experience.

Domestication of Animals

In Egypt, Mesopotamia, and some other parts of Asia cultivators early learned to domesticate animals, first the dog, then the calf, lamb, pony, and so on, and through the young their mothers also, and gradually the goat, pig, dromedary, and Asiatic elephant as well as, more or less, the cat. The male young of cattle, sheep, etc. made difficulties in the herds until men learned to castrate the surplus and to make them help in farm work, especially in ploughing—work in which the females also were and still are used.

Plough agriculture spread from S.W. Asia and Egypt over Asia and Europe, but very little into Africa. There the native grasses grow rank and coarse, poor in vitamin C, and cattle are of poor quality, often kept as a medium of exchange, especially for acquiring a wife from another group or

sub-group (this is said to be for "lobola," i.e. compensation of the woman's original group for the loss of her work when she goes into her husband's group).

Absence of ploughs, of manuring, of care of the soil, of working animals, as well as of towns, written records, institutional priest-hoods, is a feature of Africa, S. of the Sahara, with an exception to the general rule in a few cases in W. Africa. The concept of a state is little developed, save in Uganda and here and there in W. Africa. The concept of a spiritual power indwelling in a particular object, called a fetish, is widespread and should be contrasted with the idea of the sanctity of a class of objects or living things (a kind of tree or animal) found in many other regions. The village in Africa occasionally lasts for a generation or less, the people moving to a new site; the arrangement of dwellings and storehouses, etc. in the village may follow custom elaborately. Defeated and broken groups take refuge in the hot, wet forests, often at the cost of their animals, which die there from tsetse and other pests.

African food was revolutionised after contacts with America following the discovery of that continent by Europeans. Maize, manioc, sweet potato, tomato, were among the chief additions to the African menu, but varieties of yam and bean may have come in, too. In the last hundred years Europeans have penetrated everywhere in Africa, and the old order, already undermined by Arab and European slave traders, faced with a final crisis, must make adjustments (acculturation) and come into the world of commerce.

Hoe and Stick Agriculture

Though plough agriculture had spread to Java and the Philippines, and here and there beyond, before Europeans dominated the Pacific lands, the older agriculture of hoe and digging stick remained in the farther islands of Indonesia, Papua, Melanesia, and Polynesia, where yams, sago, taro, coconut, are all sources of food, along with pig and shore animals and fish. Cannibalism was partly ceremonial (to secure vital essence) and partly a means of keeping population within limits. Boat construction, little practised in Africa, was very highly developed by the Polynesians, who made voyages to Hawaii and New Zealand. It was accompanied by

skill in wood carving, in making tapa cloth (by hammering vegetable tissues together), and in several arts, some of which have been lost.

European intrusion brought disease and general decline of the old life, probably much accentuated by further penetrations during the war of 1941-45; and some groups, especially in Melanesia, are said to be dying out. The Maori of New Zealand, after a phase of decline, have adapted themselves remarkably and are increasing, having survived, not only their move to New Zealand some six centuries ago, when they had to give up a good deal of their former agriculture and find new foods, but the settlement of Europeans in their islands. Maori art (especially in wood) reveals a high quality. A social hierarchy is more developed in Melanesia and Polynesia than in many parts of Africa S. of the Sahara and Abyssinia, and Pacific methods of expressing relationship and marriage rules are subjects of study of great importance to the understanding of social structure.

Complexities of a Mixed Population

Some cultivators of the Melanesian islands are perhaps survivors of the root and tuber phase of cultivation, but the passage of Polynesians along the N. of Papua and through the Melanesian islands from Indonesia out into the Pacific has greatly influenced the life of the region. Polynesian skill in stone grinding (making Neolithic implements) is a marked feature, and inter-insular exchanges of goods are notable. It seems that many old types of skill have disappeared among small isolated groups. Indian infiltration (chiefly from S. India) in Fiji; Japanese, Chinese, and others in the Sandwich Is.; S. Arabian and Chinese in Indonesia; Dutch following Portuguese, especially in Java and Sumatra, but also in Indonesia generally; Spanish in the Philippines; British here and there, and notably (especially Scots) in New Zealand; and American in the Sandwich Is. and Samoa make the present population of the Pacific very complex socially as well as physically.

The Americas received drifts of population from N.E. Asia from late interglacial phases onwards into the Neolithic phase, but the crops and animals of farmers from the Old World did not survive the transit. Many of the pre-Columbian peoples of America

were restricted to a life of hunting and collecting or fishing, but nevertheless possessed Neolithic tools and weapons, skill in grass weaving and often in decorated pottery and modelling which in the Old World seem associated with agricultural life. In America man found food plants, notably maize, manioc, sweet potato, potato, tomato, and plantain-banana as well as varieties of palms, and America thus attained a considerable degree of equipment and settled life, with cities, calendars, states, etc., in the case of Mexico and Peru. In Peru the llama was domesticated, the only animal apart from the dog and the turkey to be tamed by man in America. It is just possible that some small groups may have drifted to America across the Pacific, but theories of pre-Columbian American life based on this supposition have on the whole failed to make themselves acceptable to expert opinion.

The Eskimo of the Arctic north are a unique case of highly specialised adaptation to a region where cultivation and herding are impossible; their skills far exceed those of most other hunter-collectors. The Eskimo and the pre-Columbian peoples of America N. of Mexico have been greatly reduced in numbers by European intrusion. In Mexico and Central and S. America, intermixture between Europeans and the earlier peoples has been much more general, and a large element of the latter survives, though their old social organization has been displaced by a system based on that of Spain and Portugal in the 16th and 17th centuries.

Introduction of Slave Labour

The introduction of negro slaves into Brazil, the W. Indies, and the U.S.A., and of Indian plantation labour into Guiana and Trinidad, has added further complications. Pre-Columbian forms of society survive only among relatively few groups, and then probably not unmodified, in British Columbia, the arid regions of S.W. U.S.A. and some spots in Central and S. America, notably on the plateaux of Brazil. A form of metallurgy had developed in pre-Columbian America, in Peru, more than elsewhere.

The region of traditional plough agriculture in the Old World comprises Europe, N. Africa, and most of Asia, in the damp areas (monsoon lands) of which rice is a leading crop. In the plough region there has been a sequence

of technical evolution from stone to copper and bronze and then to iron and steel and power machinery, with rise of cities, development of social hierarchies, spread of the horse as a factor of power, founding of priesthoods and growth of judicial and administrative systems, introduction of coinage as a vital factor in exchange, literacy and written records, organized war and conquest, all of which are studied as history, economics, psychology, geography, etc.

In that development the activities of the men of the great arid belt, which, with river breaks, stretches from the Atlantic coast of the Sahara to the Khingan mountains of Manchuria and beyond, have played a notable part. Most of the peoples of this belt cultivate fertile patches near rivers or other good sources of water; but, on the fringes of these areas of settlement and beyond them, there were, and in some places still are, groups which wander with herds in search of pasture. They usually depend for some food on the settled cultivators; and they are best looked upon as specialised groups who have detached themselves, more or less, from cultivation rather than as direct developments from hunter-collector groups. Nomad herdsmen, especially since they came to ride horses, have been noted for mobility and for their power of short-term organization and discipline for raids. They have again and again irrupted into settled areas, conquered the cultivators and formed themselves into an aristocracy. They have typically fused into the general settled population through intermarriage.

Ethnology thus studies the modes of life of the world's peoples, systems of land tenure and land use, crops and agricultural routines, care of soil, of domestic animals, systems of relationship and of marriage among peoples, types of settlement, social hierarchies, systems of education and ceremonies connected with major incidents in a person's life, schemes of government and administration. The term ethnography is best used for descriptions of particular groups in these and allied aspects, and ethnology may be reserved for the comparative study of groups with a view to the elucidation of principles applicable over a number of cases; few if any will be generally applicable. It must be realized that some scheme

of marriage, some expressions of the power quest, some form of education, some making of implements, some ceremonial, are found in every human group, and that group-life is a part of man's heritage from pre-human ancestors.

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Ethyl. Name given to the chemical group C_2H_5 . There are many compounds containing this group, the names of which often begin with the word ethyl. Ethyl Acetate, $CH_3COOC_2H_5$, is a colourless liquid with a pleasant smell, boiling at $78^\circ C.$, obtained by distilling a mixture of alcohol, acetic acid, and sulphuric acid; it is used in the preparation of fruit essences. Ethyl Chloride C_2H_5Cl , is a colourless gas boiling at $12.5^\circ C.$, used as a local anaesthetic; it is made by distilling alcohol with hydrogen chloride (hydrochloric acid) and zinc chloride and condensing the vapours by a freezing mixture. Ethyl Nitrite, $C_2H_5NO_2$, is a liquid, boiling at $17^\circ C.$; a constituent of sweet spirit of nitre, which is an alcoholic solution of ethyl nitrite and other substances. Lead Tetraethyl, $Pb(C_2H_5)_4$, is a liquid, boiling at $92^\circ C.$: when this compound is mixed with petrol used for internal combustion engines, it prevents the premature explosion known as knocking. By the thermal dissociation of lead tetraethyl the free radical ethyl was obtained by Paneth, but it has only a momentary existence as it readily combines with another ethyl group to form butane, C_4H_{10} . For Ethyl Alcohol, see Alcohol.

Ethylamine. Organic base with an ammoniacal odour, burning taste, and strong alkaline character. It is liquid, behaves in most respects like ammonia, and is used in the manufacture of some aniline dyes. First prepared by Wurtz, 1848, by distilling cyanic ether with caustic potash, ethylamine is now made by Hofmann's process, in which crude ethyl chloride, a by-product in the manufacture of chloral, is acted on by ammonia. This produces diethyloxamide, which, purified and distilled with caustic potash, yields ethylamine.

Ethyl Cellulose. Chemical product. Although cellulose esters have been known for almost a century, it was only at the begin-

ning of the 20th century that attention was turned to the cellulose ethers, mainly by Suida, Lilienfeld, Dreyfus, and Hess. Of these substances ethyl cellulose has attained greatest success, and is widely used as a basis for plastics and coating compositions. It can be prepared by the repeated treatment of alkali cellulose with ethyl sulphate at $50-55^\circ C.$; seven such treatments giving an $-OC_2H_5$ content of 55.2 p.c. as compared with 54.8 p.c. for the theoretical triethyl ether. According to patent literature, the more favoured commercial method appears to be treating cellulose suspended in 44 p.c. NaOH with excess ethyl chloride at temperatures up to $100^\circ C.$

The solubility of ethyl cellulose varies with the degree of ethylation. For plastics and lacquers the main commercial grade approximates to the di-ether with 40-48 p.c. $-OC_2H_5$, which is soluble in a wide range of organic solvents including the cheaper and readily available aromatic hydrocarbons. This wide selection of cheap solvents, coupled with the increased chemical resistance of this ether as compared with the competitive cellulose esters, has done much to contribute to its commercial success. The range of plasticisers for ethyl cellulose is unusually large, and includes, with two exceptions, all classes of materials which have been offered as flexibilising agents for coatings or plastics. Ethyl cellulose is also readily compatible with a wide range of natural and synthetic waxes. The general effect of addition of ethyl cellulose is to increase the melting point and to toughen the material, to reduce the tendency of waxes to crystallise, and to reduce tackiness of tars and pitches.

V. E. Yarsley, D.Sc.

Ethylene (C_2H_4). Colourless gas prepared by the action of sulphuric acid on alcohol, and purified by passing through sulphuric acid and caustic soda. It was first investigated, 1781, by the Dutch chemists, Deimann, Paets van Troostwyk, Bondt, and Lauwerenburgh. It is also known as heavy carburetted hydrogen, clayl, and ethene. It is easily inflammable, burns with a luminous flame, and forms an explosive mixture with air or oxygen.

Ethyl-hydrocupreine. A derivative of cupreine, an alkaloid occurring in cuprea bark (*Remijia pedunculata*).

Etiolation. The term used in plant physiology to describe a peculiar condition which appears

in normally green plants when they are grown in darkness. The plants are pale yellow where they would normally be green and in most instances their stems are abnormally long, their leaves unusually small. Internally there is a relatively scanty development of lignified tissue elements. It is probable that etiolation results, in part at least, from the modification by lack of light of the auxins controlling growth processes.

Etymology OR AETIOLOGY (Gr. *aitia*, cause; *logos*, account). The doctrine of causes, of the origin of things, specially applied to the origin of diseases. By some it is classed with ontology and teleology, as a branch of metaphysics (*q.v.*).

Etiquette. French word introduced into English to denote a routine of behaviour established by custom. It includes court ceremonial, formalities of diplomatic intercourse, procedure in parliament, in the army and navy, etc.; rules of behaviour in social intercourse; and the code observed by professional men, especially doctors and lawyers, for safeguarding the dignity and interests of their profession. Of all peoples the Chinese attach the greatest importance to etiquette. From remote times they have codified their ceremonial, and the Book of Rites, though relatively modern dates from the 1st century B.C. Many books of etiquette rules are published in Great Britain and the U.S.A.

Etive. River and sea-loch of Argyllshire, Scotland. The river flows 15 m. S.W. from Loch Mat-hair on Rannoch Muir to the head of Loch Etive. The loch extends 10½ m. S.W. and then 8½ m. W. to the Firth of Lorne. There are interest-

ing ruins on its shores. The river is noted for its salmon and trout, and for its magnificent scenery.

Etna (Lat. *Aetna*; Sicil. *Monte Gibello*). An active volcano, situated near the E. coast of Sicily, and the loftiest in Europe. Its present alt., 10,755 ft., shows a decrease of 115 ft. since 1861. The base covers an area of about 460 sq. m., and has a circumference of 90 m., while the floor of the crater, which constantly alters and has become wider in recent years, is 9,765 ft. above sea level. In the distance Etna presents the appearance of a huge symmetrical cone, but on closer observation discloses an irregular surface, studded with some 200 minor cones, attaining 3,000 ft. in height, and broken on the E. side by the Valle del Bove, a gaping abyss from 2,000 to 4,000 ft. deep. Its slope comprises three distinct



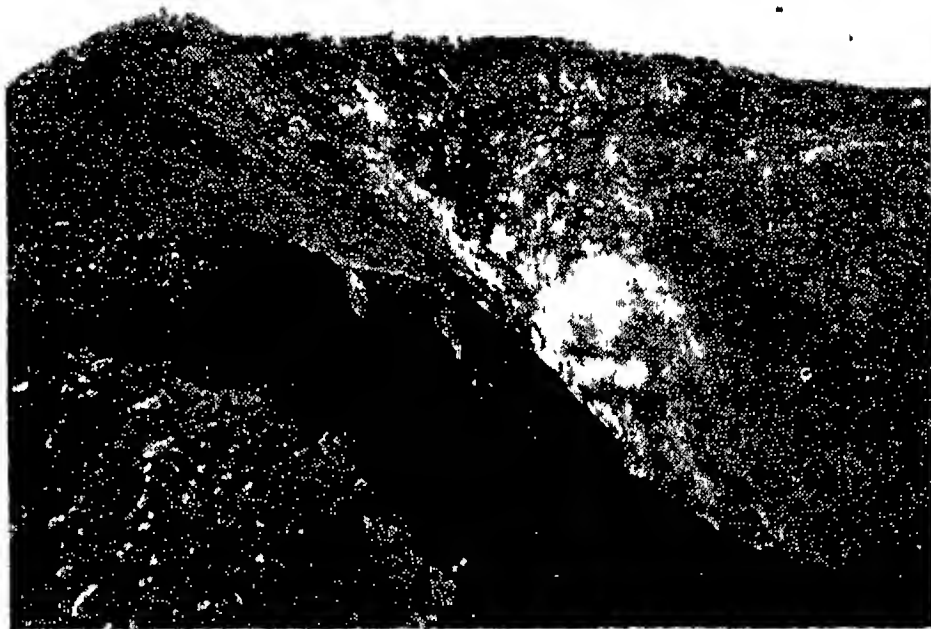
Etive. The Argyllshire loch, famous for its salmon and trout fishing

zones of vegetation. The lower, or lava, region rises 3,000 ft. from the base, and is thickly populated and well cultivated; the middle, or wooded, region, between 3,000 ft. and 6,850 ft., is covered with forests of pine, birches, and other trees; the upper, or desert, zone is a barren waste, under snow during most of the year. Pivot of the main Axis defence line in Sicily during the campaign of 1943, the mountain was wholly in Allied hands by Aug. 14, after heavy fighting in the foothills.

The ascent is generally made from Catania or Nicolosi, and 1,100 ft. from the summit is an observatory, with accommodation for tourists. Pindar describes an outbreak in 476 B.C. Violent explosions occurred in 1169, 1527, 1669, 1693, 1792, 1830, 1852, 1865, 1879, 1886, 1892 (when a new crater was formed near Monte Gemellaro), 1899, and 1910. The eruption of 1169 partly destroyed

Catania, and that of 1693 caused enormous loss of life. Among over 80 recorded activities, recent eruptions took place in 1914 and 1928, when the town of Mascati was wiped out. Legend connects the volcano with the giant Typhōn, who is said to have been buried beneath it by Zeus, and to have caused its eruptions by his heavy breathing; and with the workshops of Hephaestus (Vulcan), wherein the Cyclopes fabricated thunderbolts.

Eton. Town and parish of Bucks, England, on the left bank of the Thames, opposite Windsor. Part of the bor. constituency of Eton and Slough, it is 21 m. W.S.W. of London. Dating from Anglo-Saxon times, it has a church in Early Decorated style dedicated

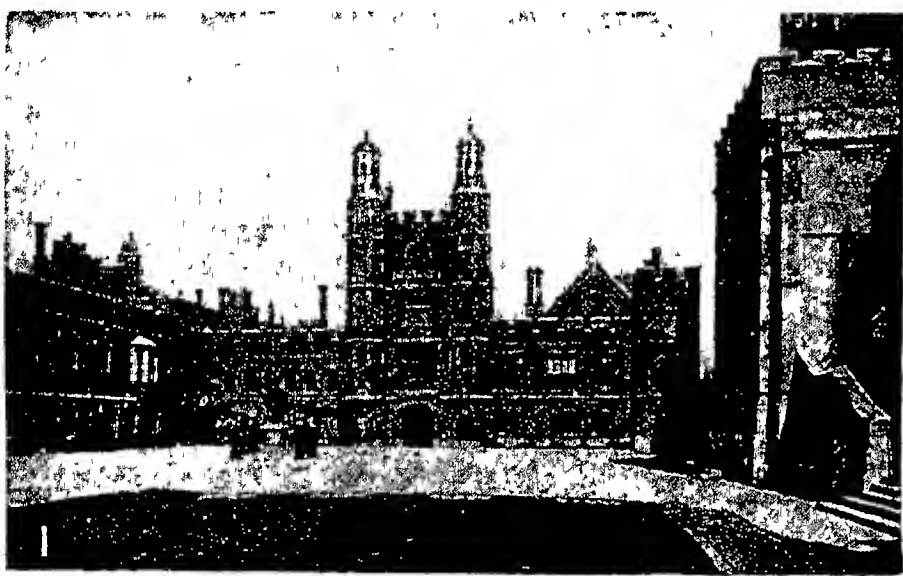


Etna. This volcano near the east coast of Sicily is still active, and the lower photograph shows it in eruption. Top, closer view of the crater

to S. John the Evangelist, 1852-54, and a noted inn, the Christopher. Pop. (1951) 3,250.

Eton College. English public school. Founded by Henry VI as the College of the Blessed Mary of Eton beside Windsor, and now known as the King's College of Our Lady of Eton beside Windsor, its first charter is dated 1440. A supplementary charter

Eton College arms was granted in 1441, when the buildings were begun. The original constitution (based upon that of Winchester, 1382) provided for a provost, head master, 10 fellows, four clerks, six choristers, 25 poor scholars, and 25 bedesmen. Henry Sever was the first provost, succeeded by William of Waynflete, 1443. Among the heads have been Nicholas Udall,



1505-66, John Keate, the famous flogger, 1773-1852, J. J. Hornby, 1826-1909, Edmond Warre, and Cyril Alington. Arms were granted to the College in 1449.

The founder's statutes were formally repealed in 1871. The foundation now consists of the provost, appointed by the crown, 10 fellows, who form the governing body, vice-provost, head and lower masters, one or more bursars, and two chaplains or conducts. The number of collegers (or Tugs) is 70. In 1947, in addition to the college proper, there were 25 houses and over 1,100 king's scholars and oppidans or house residents. There are 87 masters. Notable scholars have included Bolingbroke, Boyle, Canning, Chatham, Fox, Gladstone, Gray, Hallam, Kinglake, Milman, Peel, Porson, Pusey, Shelley, Swinburne, and Wellington. The remark traditionally ascribed to Wellington, that Waterloo was won on the playing-fields of Eton, is of doubtful authenticity.

In another war, these famous playing fields were selected in 1940



Eton. The town, seen from Windsor; in the centre is the college chapel

as the chief assembly point for evacuated government officials moving from London in the event of a German invasion of Great Britain.

Of the buildings, the hall, 1448, restored 1858, is the only part built according to the founder's final plan. The Perpendicular chapel, 1442-80, originally parochial as well as collegiate, resembles that of King's College, Cambridge, and was restored in 1848-60. The old buildings, of dark red brick, with stone dressings and clustered chimney



shafts, form three sides of a quadrangle, which is completed by the chapel. Restoration of the vestry chapel was part of the First Great War memorial. The library was built in 1729, and new buildings in 1844-46 and 1885-87. In athletics the wall game is a special feature, and the rowing boys are known as "wet bobs," the cricket-

ers as "dry bobs." The school gives its name to the stiff collar and short jacket worn by boys.

Bibliography. Annals of Eton, W. Sterry, 1898; Fasti Etonenses, A. C. Benson, 1899; Hist. of Eton College, L. Cust, 1899; Eton, A. Clutton-Brock, 1900; History of Eton College, H. C. Maxwell Lyte, 4th ed. 1911; Eton College, C. E. C. Hussey, 1922.

Étourdi, L'; OR LES CONTRETEMPS (The Thoughtless; or The Mishaps). Five-act comedy by Molière, first produced in 1653. The title refers to the character Lélie, who often does the wrong thing from right motives.

Étretat. Town and resort of France, in the dept. of Seine-Maritime. Facing the English Channel, 16 m. N.N.E. of Havre, it became a popular holiday resort in the latter part of the 19th century. The chief building is the Romanesque church of Notre Dame, partly 11th-century. There are public gardens, a casino, and bathing facilities. Pop. (1954) 1,876.

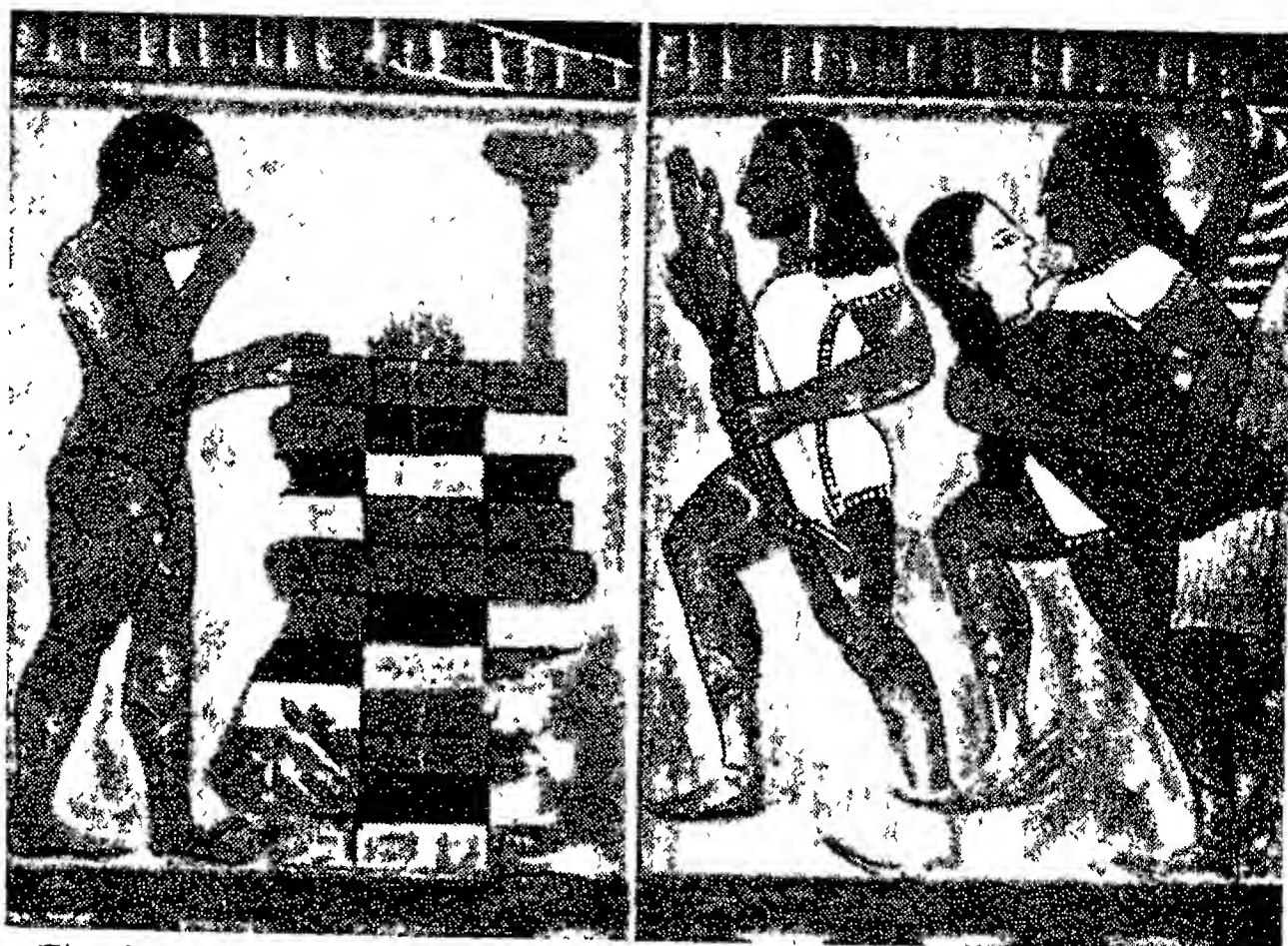
Etruria (Gr. Tyrrhēnia). Ancient region of Italy nearly corresponding to modern Tuscany. The origin of its inhabitants, the Etruscans, is disputed, some scholars following the ancient tradition that they came from Asia Minor about 850 B.C., others believing that they belonged to an early, pre-Indo-European stratum of the population of Italy.



Eton College. 1. The School Yard and Lupton's Tower, built in the 16th century. 2. The Upper School, built 1690-91. 3. The Hall, one of the original buildings of Henry VI, restored in 1858

Their language, of which numerous inscriptions in a form of the Greek alphabet are known, but of which only about 100 words can be construed, was pre-Indo-European; they called themselves *Rasenna*. The chief authority was in the hands of an aristocratic caste called *lucomons*; the 12 principal cities were confederated, with a general council controlling matters of peace and war. The Etruscans were at the height of their power during the 7th-5th centuries B.C., based chiefly on the exploitation of their iron and copper mines. They dominated Campania and Latium, and Etruscan kings reigned in Rome during the 6th century; they had cities north of the Apennines. They allied themselves with the Carthaginians to keep the Greeks out of the western Mediterranean; but the Greeks, who had many colonies in S. Italy, defeated an Etruscan fleet off Cumae in 474, after which Etruscan sea power declined. Rome drove out its Etruscan kings c. 510, destroyed Veii in 396, and by 285 dominated Etruria; the advance of the Gauls drove the Etruscans from the Po valley.

Rome's debt to the Etruscans was great, especially in religious matters. The name *Roma* is



Etruria. Paintings discovered at Cervetri, the ancient Etruscan city of Caere, illustrating the ceremonial burning of the dead

By courtesy of Wm. Heinemann

and, later, by the Greeks; quantities of Corinthian and Attic pottery found its way to Etruria. Another influence was the native Villanovan art. The jewelry, ivories, and bronzework found in Etruscan tombs are of a very fine quality. Many splendid bronze figures of human beings and beasts have survived, the best known being the Capitoline wolf. The

Etruscans also made particularly their own the art of moulding figures in terra-cotta. Some of these, of large size, adorn their sarcophagi; others, such as the Apollo of Veii, were set up on their temples. Their tomb frescoes depict the life of the Etruscan nobles and their

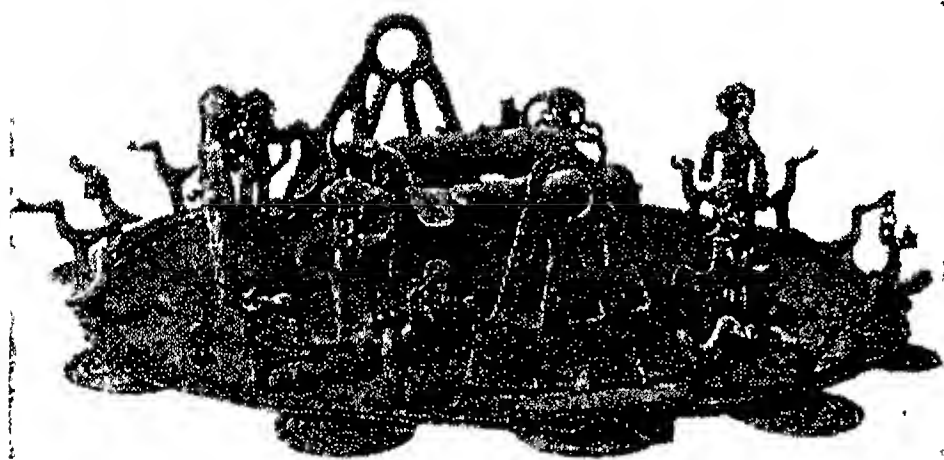
into the offices of a large iron, steel, and coal works.

Etruria Marls. In geology, beds of red and purple marl and clay, occurring in the upper coal measure strata of the coal-basins of the Midlands and N. of England. They are used to make pottery.

Ettlingen. Town of Baden-Württemberg, W. Germany. It stands on the Alb, 4 m. S. of Karlsruhe. The chief buildings are a castle, standing in large grounds, the town hall, several churches, and a former monastery. It is still surrounded by walls and a moat. Its industries include the manufacture of paper, dating from before 1500, textiles of various kinds, and machinery. A Roman station, Ettlingen was made a town in 1227. It is famous for the battle fought here between the French and the Austrians, July 9-10, 1796, the French being the victors.

Ettmüller, ERNST MORITZ LUDWIG (1802-77). German philologist. Born at Gersdorf, Saxony, Oct. 5, 1802, he became professor of German literature at the Zürich gymnasium, 1833, and professor at the university there, 1863. His writings contributed a great deal to the knowledge of early German, Anglo-Saxon, and Scandinavian literatures. His best known works are a translation of *Beowulf*, 1940, and a *Lexicon Anglo-Saxonicum*, 1851. He died April 15, 1877.

Ettrick Forest. District of Selkirkshire, Scotland. The forest formerly covered Selkirkshire and portions of Peeblesshire and Midlothian, and was at one time a hunting ground of the Scottish kings. Since the 16th century it has been used as sheep pasturage.



Etruria. Plate of primitive Etruscan work ornamented with figures: it depicts a ploughing scene
British Museum

Etruscan, as are: the threefold Capitoline temple and the triad, Jupiter, Juno, Minerva; the curule chair; the fasces; the rituals of divination. Gladiatorial fights, originally held as funeral games, reached Rome from the Etruscans via Campania.

Material survivals of the Etruscans include remnants of great city walls (as at Fiesole and Volterra) and of regularly planned towns (Marzabotto). The most famous remains are the tombs and their contents, notably the tumuli of Cervetri and the painted underground chambers of Tarquinii.

The Etruscans excelled in sculpture and in the minor arts and were influenced, through their commerce, by the Phoenicians

conception of the underworld. They were skilled musicians, their national instrument being the flute. *Consult* Cities and Cemeteries of Etruria, G. Dennis, ed. Lindsay, 1907; Villanovans and Early Etruscans, D. Randall-McIver, 1924; Etruria and Rome, R. A. L. Fell, 1924; Etruscan Sculpture, Phaidon Press, 1941; The Etruscans, M. Pallottino, 1955; Art of the Etruscans, M. Pallottino and M. Hürlimann, 1955.

Etruria. Ecol. dist. and village of Staffordshire, England. It is within the city of Stoke-on-Trent, and has its own railway station. Josiah Wedgwood established his pottery works here in 1769. Etruria Hall, where Wedgwood died in 1795, has been converted

Ettrick Water. River of Selkirkshire, Scotland. It rises in Ettrick Pen and flows 32 m. N.E. to the Tweed, about 2 m. below Selkirk. In the churchyard of Ettrick parish are buried James Hogg, the "Ettrick shepherd," Thomas Boston, Puritan divine, and Tibbie Shiel (1782-1878), who kept the famous inn at the head of St. Mary's Loch.

Etty, WILLIAM (1787-1849). An English painter. Born in York, March 10, 1787, he was apprenticed to a printer in Hull. Coming to London, he began copying famous pictures, in 1806 entered the R. A. schools, and was a pupil of Lawrence. Between 1816 and 1824 he made several visits to the



Wm Etty
From a photo, 1849

Continent, chiefly to Italy, whence he returned with a fine sense of colour and of graceful composition. In 1824 he was elected A.R.A., and R.A. in 1828. He died in York, Nov. 13, 1849. Not until late in life did he obtain good prices for his work, probably owing to his preference for vast canvases. He excelled in the painting of the nude figure, though his literal treatment of it may still arouse distaste. Of his smaller pictures *Youth on the Prow and Pleasure at the Helm*, in the Tate Gallery, London, is the most popular. The nobility and dignity of his huge works, such as *The Combat* and the three *Judith* pictures at Edinburgh, and *Ulysses and the Sirens* in the Royal Institution, Manchester, compel admiration.

Etymology (Gr. *etymon*, true; *logos*, science). The investigation of the origin and meaning of words. The term dates back to the early schools of Greek philosophy, whose theories are ridiculed by Plato in the *Cratylus*, where he himself propounds some extraordinary derivations. The Stoics and Alexandrian grammarians also devoted much attention to the study of words and the parts of speech. Owing to complete ignorance of phonetic laws, the older etymologists laid down arbitrary and impossible sound changes, and even went so far as to derive words from others of opposite meaning, e.g. *lucus* (grove), a *non lucendo* (from not shining). In the Middle Ages the influence of

theology led to the attempt to derive everything from Hebrew as the parent of all languages.

Etymology as a science is of comparatively recent origin, and became possible with the introduction of a knowledge of Sanskrit into Europe by Sir William Jones. This led to a thorough examination of the vocabulary of the Indo-European languages and the establishment of certain fixed principles of sound-change which governed the changes in the form of a word in different languages.

What is called popular etymology is really false analogy, and is an endeavour to adapt the form of a word not directly intelligible to that of one more familiar and apparently related; e.g. crawfish (Fr. *écrevisse*), wormwood (Ger. *Wermuth*), bridegroom (A.S. *brideguma*, brideman). See Language; Philology; Place Names.

Eu. Town of Normandy, France, in the dept. of Seine-Maritime. It stands on the Bresle, 64 m. N.N.E. of Rouen. It has a few industries, flour mills, brickyards, and glass works among them, and a transit trade, but its main interest is historical. The church of S. Lawrence is a fine Gothic building of the 12th and 13th centuries, and the château, partly burned down in 1902, dates from the 16th century, when it replaced an older one. Louis Philippe, who restored it, often resided here. The name appears to be a derivative of Lat. *Augusta*. Pop. (1954) 6,343.

Euboea (Turk. *Egripo*; Ital. *Negroponte*). A large island of Greece, in the Aegean Sea. It lies off the E. coasts of Boeotia and Attica, has a length of 115 m., a breadth varying from 4 m. to 32 m. and is separated from the mainland by a narrow channel called Euripus. The surface is mountainous with fertile valleys, pasturing large herds of cattle. Oil, wine, corn, fruit, honey, and pitch are produced, but stock-breeding is the principal occupation. The highest point is Mt. Delphi, 5,720 ft. The thermal springs of Euboea have been esteemed since ancient



Eucharis amazonica, a South American bulbous herb

times. The chief town is Chalcis. The island's history is merged in that of Greece and Rome. In medieval times it belonged to Venice. It was taken by the Turks in 1470, and in 1830 was restored to Greece. In 1941 it was occupied by Axis forces who were found to have evacuated it when British troops landed Oct. 23, 1944. Area 1,430 sq. m. Pop. 179,523. *Pron.* Ev-via.

Eubulus (d. 330 B.C.). Greek orator and demagogue. He was a friend of Aeschines, whose clerk he had been, and a violent opponent of Demosthenes. It was chiefly owing to him that Aeschines was acquitted when accused of treacherous dealings with Philip of Macedon. A decided pacifist, Eubulus carried a proposal that whoever suggested applying any portion of the theoric or festival fund to any other purpose, such as war, should be put to death. In 346 B.C., negotiating with Philip, he concluded a peace highly disadvantageous to Athens.

Eucaïne, BETA-EUCAINE, OR BENZAMINE. Artificially prepared alkaloid allied to cocaine. It is used as a local anaesthetic in the form of its salts, beta-eucaïne hydrochloride or lactate, but has been largely superseded by newer agents of this class. It is safer than cocaine but less powerful.

Eucalyptus (Gr. *eu*, well; *kalyp-tos*, covered). Genus of trees of the family Myrtaceae. The name is given to it because the sepals cover thoroughly the unexpanded flowers. See Gum.

Eucalyptus Gum. Exudate of the red gum-tree of Australia. It contains tannic acid and is a powerful astringent, being used in lozenges or in gargles for relaxed throat, and occasionally prescribed in diarrhoea and dysentery. Eucalyptus oil is distilled from the *Eucalyptus globulus*, the blue gum-tree. It is used as an antiseptic and as an inhalation or spray for colds and in conditions accompanied by foetid expectoration. Mixed with an equal amount of olive oil it is rubbed in locally for rheumatism.

Eucharis (Gr. *eucharis*, pleasing). Small genus of bulbous herbs of the family Amaryllidaceae. Natives of Colombia, they have egg-shaped bulbs, broad, elliptical leaves with long stalks, and white flowers, from 3 to 5 ins. across. These are borne in clusters on top of a tall stem, and consist of a slender tube expanding into a cup surrounded by six sepals and petals.

Eucharist (Gr. *eucharistia*, thanksgiving). One of the names used from early times for the Sacrament of the Lord's Supper. The term occurs frequently in the N.T. in the general sense of thanksgiving, but for the most part without special reference to the Lord's Supper or Holy Communion. The special application of the word arose from the Gospel accounts of the Supper, in which Christ is recorded to have given thanks over both the bread and the cup. The Apostles followed His example, and thus the blessing or consecration of the elements became known as a eucharist or thanksgiving. Later the

tions prefer the primitive name of the Lord's Supper.

As the central act of worship, the Eucharist has been the cause of much embittered controversy. The history of Eucharistic doctrine exhibits two main points at issue: (1) the nature and method of the presence of Christ in, or associated with, the consecrated elements; (2) the sacrificial aspect of the service. From comparatively early times it was held that after the act of consecration, the Body and Blood of Christ are really and substantially present, and "are verily and indeed taken and received by the faithful in the Lord's Supper."

But in defining the method of the mysterious Presence, wide differences of opinion arose.

Throughout the Western Church the doctrine of Transubstantiation became, in the course of time, a matter of faith. This taught that the substance of the elements was changed into or replaced by that of the Body and Blood of Christ, so that only the accidents or appearance of the bread and wine remain. Consubstantiation taught that both substances are present as a compound substance. At the Reformation, Transubstantiation was generally abandoned by Protest-

of the sacrifice of Christ on Calvary, but not a repetition of it. The various Protestant churches altogether reject the sacrificial idea.

In primitive times the Eucharist was celebrated in the evening, but from the time of Trajan it began to be a morning service. This practice has prevailed ever since, except in the Free Churches, and is connected with the ancient custom of receiving the Communion fasting. At first the celebration of the Eucharist followed the Agape (*q.v.*) or common meal, and was probably held daily. Later on the two were separated, and as a rule the Communion service was held on Sundays and Festival days. There is evidence that in some of the larger churches daily celebrations took place, but this was not the general custom. Originally all the faithful communicated at each celebration, the catechumens, penitents, and strangers withdrawing before the consecration; but as the sacrificial aspect became emphasised, the practice of non-communicating attendance became common, all the faithful attending each service, but only communicating occasionally or on obligatory feasts.

Except the Church of Rome, all Churches from Apostolic days have given Communion to the people in both kinds. In the Roman Church the cup has not been given to the laity through fear of accidents since the 14th century; while in the Greek Church the consecrated bread is dipped in the cup, and the elements are thus given together. Throughout the Western Church unleavened bread has been used; but this practice has not been adopted by the Eastern Churches. In the Anglican Church either kind of bread is permissible. The practice of adding water to the wine is general, except in Protestant churches, on the ground that the cup was thus mixed at the Passover.

The reception of Holy Communion is a condition of membership throughout the Christian Church. The Roman Church requires at least one annual participation at Easter; the Anglican Church fixes three times a year, Easter to be one, as the minimum. See Communion; Consubstantiation; Mass; Real Presence; Sacrament; Transubstantiation.

Eucharistic Congress. A meeting, at first local, but subsequently of an international character, attended by R.C. ecclesiastics and laymen, and held at intervals normally of one year. The first was at Lille in 1881. That held in London in 1908 was regarded as being of special importance.



Eucharist. S. Benedict celebrating Mass, from the painting by Sebastiano Ricci (1662-1734) in the academy of S. Fernando, Madrid

consecrated elements themselves became known as *eucharistia*, and the service itself was called the Eucharist, as being the Christian sacrifice or offering of thanksgiving and praise.

The Eucharist is the act of united worship directly commanded by Christ Himself in the words, "Do this in remembrance of Me." It has always been the central act of Christian worship in all the churches, save in a few bodies, such as the Quakers and the Salvation Army. In the early Church it was commonly called the Oblation or Liturgy, as it is still in the Eastern Churches. The Roman Church styles it the Mass, the Anglican Church Holy Communion, while most of the Protestant denomina-

ant bodies; but no one theory took its place. The Lutheran view was nearly identical with Consubstantiation; the Anglican Church maintained the Real Presence, but without defining its method; and most other reformed churches adopted the view of Calvin that there is no Real Presence in the elements themselves, but simply a spiritual presence of Christ in the souls of the faithful.

As regards the sacrificial aspect, the Roman Church teaches that in the Eucharist there is a "true and proper" sacrifice of Christ, Who is offered to the Father as a propitiation for both living and departed. The Eastern and Anglican Churches recognize a perpetual memorial or pleading before God

Euchlorine (ClO_2). Yellow gas formed when potassium chlorate is treated with hydrochloric acid. First prepared by Davy in 1815, it was thought to be a new oxide of chlorine, but is merely a mixture of chlorine and chlorine dioxide. An efficient disinfectant, it is sometimes used instead of chlorine.

Euchre. Game played with 32 playing cards, the 2, 3, 4, 5, and 6 of each suit being thrown out. There are two players, or four in partnership. The dealer gives five cards to each player, three at a time and then two, turning up the next face upwards on the pack for trumps. The knave of trumps, the "right bower," is highest card, the other knave of the same colour, the "left bower," coming next. The remaining cards of these two suits, and all those of the other suits, rank from ace (top) to seven.

In the two-handed game the non-dealer begins by deciding whether he shall play or pass. If satisfied that he can win the odd trick he says, "Order it up." His opponent then puts one card face downwards on the table and is entitled to the card turned up for trumps, but generally leaves this card until he wishes to play it. Should the non-dealer be dissatisfied, he passes; the dealer may then either take up the top card in exchange for one of his own, and play, or he may pass also. Both having passed in turn, either player has the chance of going on any other suit he chooses to make trumps. If both pass again, the hands are thrown in.

Two cards constitute a trick. A player must follow suit if he can, but need not take a trick unless a higher card is his only play in that suit. The game is five up. If the player ordering up succeeds in making five tricks he wins a *march*, and scores two points; if three tricks, he makes the point, and scores 1 (four tricks count the same as three). If he fails to make three tricks he is *euchred*, and his opponent scores 2. *Pron.* U-ker.

Eucken, RUDOLF CHRISTOPH (1846-1926). German theologian and philosophical writer. Born Jan. 5, 1846, in E. Friesland, he was educated at Göttingen and Berlin. He was professor of philosophy at Basel from 1871 to 1874, then until 1920 at Jena. He died Sept. 14, 1926. His views and writings show the influence of Plato and the elder Fichte. He upholds the Christian standpoint, and is the opponent of naturalism in all its forms, whether as empiri-

cism, positivism, or utilitarianism. His chief works translated into English are: *The Fundamental Concepts of Modern Philosophic Thought*, 1880; *The Problem of Human Life*, 1909; *Christianity and the New Idealism*, 1909; *Life, Work, and Travels*, 1922. *Pron.* Oyken.

Euclase (Gr. *eu*, well, *klasis*, breaking). Rare mineral consisting of basic silicate of beryllium and alumina. Occurring in short prisms, with a perfect cleavage, it is either colourless, yellowish, green, or blue. Occasionally cut as a gem-stone, it resembles aquamarine or topaz. It is found in Minas Geraes, Brazil, in the Ural mts., Austrian Alps, etc.

Eucleides of ALEXANDRIA (fl. 300 B.C.). Greek mathematician, called Euclid in English. He was of Greek descent and taught at Alexandria (where he may have founded the school) during the reign of Ptolemy I, 305-285 B.C. His most famous work is the *Elements* (see Euclid); but other treatises have survived, notably *Data*, and *On Divisions* (geometrical), *Phaenomena* (astronomical), and *Optics*. He is supposed to have replied to Ptolemy, who asked for something simpler than the *Elements*, "There is no royal road to geometry."

Eucleides of MEGARA (d. c. 374 B.C.). Greek philosopher. A native of Megara, he founded the Megarian school, one of the so-called imperfect Socratic philosophical schools. He held that there was only one good (Reason, Truth), and only one virtue (a knowledge of this good), all else being non-existent—a Socratic modification of the Eleatic doctrine of the Absolute One.

Euclid. Term commonly applied to the collection of mathematical knowledge, the *Elements*, compiled by Eucleides of Alexandria (v.s.) at the beginning of the 3rd century B.C., and particularly to that part (books I-VI and XI-XIII) which organized virtually all the geometrical theorems then known into a unified and self-consistent deductive system. The proofs were arranged to build up by logical necessity from a certain number of obvious truths (axioms) and permitted constructions (postulates), all of which were explicitly stated. The *Elements*, with little alteration, became the basis for the teaching of geometry in schools down to the end of the 19th cent. The approach to the subject then became more practical.

The word Euclid is also sometimes used to indicate Euclidean

geometry, as distinct from more recent studies of non-Euclidean (i.e. curved) spaces. See *Geometry*.

Eucrite. Crystalline granular rock, a variety of gabbro. It is characterised by the presence, among mineral constituents, of basic species of feldspar. It is well developed in Tertiary eruptive rock in the Isle of Rum, Scotland, and near Carlingford, Eire.

Eudaemonism (Gr. *eudaimonismos*). Greek term for the theory that happiness (*eudaimonia*) is the chief end of life. This happiness, according to Aristotle, must be striven after for its own sake, not as a means to an end, and is defined by him as a perfect activity in a perfect life. The most excellent and specially human activity is that of the reason; happiness therefore is to be sought in a contemplative, otherwise a virtuous, life. Eudaemonism is to be distinguished from Hedonism (q.v.).

Eudiometer (Gr. *eudia*, fine weather; *metron*, measure). Instrument used for measuring volume changes in chemical reactions between gases. Originally designed for determining the amount of oxygen contained in a sample of air, it is now commonly used for determining the constituents of a gaseous mixture. In some forms it comprises a graduated glass tube or cylinder, either straight or U-shaped, closed up at one end and open at the other, and having inserted near the closed end two platinum wires, which are near enough to allow the passage of an electric spark through the mixture.

A Cavendish eudiometer is a vessel closed at both ends, having a screwed connexion by which it can be pumped clear of air before being filled with a gaseous mixture for analysis. A mixture of two volumes of hydrogen and one of oxygen can be exploded in a eudiometer tube to form water.

Eudocia (c. 393-460). East Roman empress. Daughter of the Athenian philosopher Leontius, celebrated for her beauty and intellect, she was converted to Christianity by Pulcheria, sister of Theodosius II, the latter marrying her in 421. Before conversion her name was Athenais. The two sisters-in-law, however, quarrelled over the Eutychian heresy (see Eutyches), and Eudocia was banished, returning to a life of good works at Jerusalem. She wrote several poems.

Euganean Hills. Isolated group of hills in N.E. Italy, in the prov. of Padua. Lying in the W. of the prov., they are of volcanic origin.

have numerous thermal springs, and extensive trachyte quarries. The loftiest point is Monte Venda, 1,895 ft. On their slopes are several villas and a ruined convent. They gave the title to some lines written by Shelley in 1818.

Eugene. City of Oregon, U.S.A. the co. seat of Lane co. It stands on the Willamette river, 125 m. S. of Portland, 50 m. from the Pacific, and is served by rly. and airport. It is the seat of the Oregon university (opened 1872). It has flour and lumber mills, brick and tile works, rly. shops, and fruit-packing plants. Eugene is at the head of navigation, and carries on a brisk trade in lumber, cereals, cattle and animal products, and canned fruit. It is a rapidly growing city, settled in 1854, and incorporated 10 years later. Pop. (1950) 35,879.



Prince Eugene,
Austrian soldier
From a contemp.
portrait

Eugene (1663–1736). Italian prince and Austrian soldier. Born in Paris, Oct. 18, 1663, his father was Eugene Maurice, prince of Savoy, and his mother a Frenchwoman, a niece of Mazarin. He was baptized François Eugène. Educated in France, at first for the church, he entered the Austrian army, as Louis XIV would not admit him to the French, a fact which some think gave a distinct anti-French impetus to his military career. His early experiences were gained fighting against the Turks, and his advance was rapid in his profession.

In 1691 Eugene held a command in Italy, where by 1693 he had won several successes over the French. In 1697, in command of the imperialists in Hungary, he crushed the Turks at Zenta. In 1701, when the War of the Spanish Succession broke out, he was sent to Italy, where again he won considerable successes over the French. In 1704 began the association with Marlborough which has linked together the two names in history. The prince helped in the battle of Blenheim, but when Ramillies was fought (1706) he was again in Italy where his outstanding feat was the capture of Turin. He fought at Oudenarde, but after the English had withdrawn from the struggle, he advised his master, the emperor, to do the same. This

counsel being taken, he arranged in 1714 the peace of Rastatt.

Next began one of Eugene's greatest campaigns, the one that made him the idol of the Austrians. In the war against the Turks that opened in 1716, he won a victory at Peterwardein, and a greater one when he captured Belgrade. A period of peace followed, the prince serving as governor for the Netherlands, and then as the emperor's representative in Italy. In 1734 he led the Austrians in the War of the Polish Succession, and on April 21, 1736, he died in Vienna.

The greatest of all the soldiers who have served Austria, Eugene was responsible for the only period in her military history that can be called glorious. He had a passion for war, the genius that knew instinctively when risks could be taken, for several of his victories were won over greatly superior forces. He was interested in art, and left a magnificent collection of pictures. The prince never married. There are Lives by G. B. Malleson, 1888; P. Frischauer, 1934; Sir G. MacMunn, 1934.

Eugène LOUIS JEAN JOSEPH (1856–79). A French prince. The only son of Napoleon III and Eugénie, he was born in Paris March 16, 1856, and was usually known as the Prince Imperial. Having undergone a military training at Woolwich, 1872–75, he joined the British expedition to Zululand in 1879. He was killed near Ulundi on June 1.

Eugenics (Gr. *eugenēs*, well born). The study of agencies under social control that may improve or impair the racial qualities of future generations. That is the original definition of eugenics by the coiner of the word and the founder of the study, Sir Francis Galton (*q.v.*), cousin of Charles Darwin. Before his death in 1911, Galton founded the Galton and Eugenics laboratories at University College, London, and the Eugenics Education (later the Eugenics) society. The two former were essentially research organizations for the study of human heredity and breeding, while the primary object of the latter was the general diffusion of the knowledge gained. The society, however, also plays a considerable part in initiating and financing pure research. These three parent bodies now have equivalent organizations in most parts of the civilized world, and eugenics has become, like its parent science biology, a subject of international interest.

Eugenics has one fundamental premise, which aroused widespread hostility when it was first enunciated during the 19th cent., since it was a development of the then revolutionary theory of evolution, which contradicted the biblical creed of the special creation of man. It is that human beings inherit qualities just as do other animals. A country, therefore, which is concerned with the quality of its citizens, should have regard to their nature as well as their nurture, *e.g.* to their native health and intelligence as well as to their feeding and teaching at school. A subsidiary biological premise lends urgency to the eugenic attitude. That is, that natural selection—the survival of the fittest, in the widest sense of the term—is today profoundly modified by social agencies. Whereas among wild animals or mankind in primitive states the healthiest and most intelligent, broadly speaking, live to be the parents of the next generation, a civilized human community tends (*a*) to preserve, and permit to breed, mentally and physically defective individuals who would not in a primitive culture survive childhood; and (*b*) to put a premium through economic conditions on celibacy and childlessness among the most vigorous and successful in the community.

Heredity and Vital Statistics

The study or science of eugenics—as distinct from its practical application—is therefore simply a branch of biology, and one that falls naturally into two parts—the study of human heredity, and the study of birth rates, death rates, marriage rates, and similar relevant population statistics. Population and eugenics, indeed, are simply the quantitative and qualitative aspects of the same thing.

Human heredity, likewise, is very largely studied by statistical methods. The biometrical (life measurement) approach initiated by Galton himself is essentially statistical, and so are the methods of analysis of that science of genetics (study of heredity) which developed during the last half-century from the original studies of the Abbé Mendel (*see* Mendelism).

Owing to the popular prejudice against regarding man as an animal much of the earlier eugenic literature was devoted to proving that human heredity conformed to the ordinary laws of genetics and general biology. That case can now be considered proved. More is known today, indeed, about the heredity of man than about that of

any other animal, barring a few small, fast-breeding species studied in laboratories. For the past quarter of a century, therefore, emphasis has been directed more to the intensive study of the inheritance of special human characters, normal and subnormal, and to the eugenic aspects of population trends, *e.g.* to finding out the birth and survival rates of the "social problem group" in relation to those of the general population. The objects of the practical eugenic measures that are advocated are both negative—to check racial deterioration—and positive, to raise the racial standard. Sterilization of the certifiably unfit—chiefly the insane and mentally defective—is one negative measure proposed. Closely associated with it is the finding and teaching of methods of birth control simple enough to be used effectively by the simple-minded. A third recommended measure is to call a halt to the provision of indiscriminate state assistance which, eugenicists claim, puts a premium on irresponsible parenthood.

The positive objective of increasing reproduction among the ablest and fittest can, eugenicists believe, be achieved by such economic and social measures as would foster among them early marriage and families with a minimum of three children. They advocate especially granting selective family allowances for professional men on a scale that would prevent the rearing of a family from depressing the family man's economic status below that of his celibate or childless fellow professional. Eugenists consider education, especially in bringing up the young to think eugenically in choosing a mate and producing children, of great importance in the development of both positive and negative eugenics.

Limited Range of Study

The weakness of the eugenic case is that as the life-span of the investigator into human heredity is no longer than that of his subject, his study is limited to at most three generations. Conclusions which one investigator from this limited range of observation may consider established might well be nullified by wider observation. The negative objective of preventing reproduction by subnormal human beings appears to be more soundly based than that of the positive objective: the assumption that the gifted and successful will necessarily produce better offspring than the normal is by no means established. See

Biology; Genetics; Heredity; Mendelism; *also* Birth Control; Birth Rate; Death Rate; Population; Vital Statistics.

Eldon Moore

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Eugénie (1826–1920). Empress of the French. Daughter of the Spanish count de Montijo, she



Eugénie, Empress of the French

was born at Granada, May 5, 1826. She went to France in 1851 and married Napoleon III on Jan. 30, 1853. Under her influence the French court became a centre of luxury and extravagance. She was partially responsible for the disastrous French expedition to Mexico in 1863–66 in favour of the Emperor Maximilian, and encouraged Napoleon to embark upon the war with Prussia in 1870. After the French defeat at Sedan, she fled to England, where she was joined by the emperor, and they settled at Chislehurst. Napoleon died in 1873, and her only son, Eugène, the Prince Imperial, was killed in 1879 while serving with the British army in the Zulu campaign. The ex-empress moved to Farnborough, Hants, in 1887. She died July 11, 1920, while on a visit to Spain. Together with Napoleon III and her son, she is buried in the mausoleum at Farnborough. *Consult* Memoirs, Comte Fleury, 1920; Lives, M. Paléologue, Eng. trans. H. Miles, 1928; R. Sencourt, 1931; O. Aubry, 1939.

Eugenius. Name of four popes, of whom two are notable. Eugenius III, pope 1145–53, was born Bernardo Paganelli at Pisa, where he was educated and ordained. He joined the Cistercian Order, came under the influence of Bernard of Clairvaux, and was made abbot of the monastery of Tre Fontane at Rome. His elevation to the papacy coincided with a revolt against the temporal supremacy, and he was driven to Viterbo. The activities of Arnold

of Brescia (*q.v.*) compelled him to leave Italy, 1146. In France he promoted the second crusade, and promulgated measures for the reform of the clergy. It was not until shortly before his death, July 8, 1153, that, thanks to the intervention of the emperor, Frederick Barbarossa, he was able to return to Rome.

Eugenius IV, pope 1431–47, was a Venetian named Gabriel Condolmieri and a monk of the Celestine order. He was bishop of Siena before being chosen pope. He was engaged in a struggle with the Colonna family, and then with the council of Basel, which refused to dissolve on his order in 1431, the recalcitrants of the council declaring him suspended and deposed, and electing the anti-pope Amadeus of Savoy (Felix V). Outside a comparatively small party, however, Eugenius maintained his position as rightful pope. During 1433–43 he was driven to live at Florence by a revolt of the Romans. He effected a temporary union with the Greek and Armenian churches, 1439. He died Feb. 23, 1447.

Eugenol. Chief constituent of clove oil (80 to 90 p.c.). Obtained by distilling cloves, and from pimento-leaf oil, it has the same spicy odour as clove oil, from which it is separated by caustic potash. Eugenol is used medicinally as a carminative, and frequently as a palliative in toothache, a pledget of cotton-wool wetted with eugenol being inserted into the hollow tooth. Commercially eugenol is of importance in the manufacture of vanillin.

Eugubine Tables. Seven large bronze tablets found in 1444 in a vault near Gubbio (ancient Iguvium, medieval Eugubium), in central Italy. They are covered with inscriptions in Umbrian and Latin, one in both languages, in excellent preservation. The oldest date from 200 B.C. They embody almost all that is known of the Umbrian dialect and throw valuable light upon the religious customs of ancient Italy. The text contains the proceedings of a priestly corporation named the Attidian brothers, a code of religious ceremonies with directions for auguries, sacrifices, and expiatory ceremonies. See Inscriptions.

Euhemerus (4th century B.C.). Greek rationalist. A native of Sicily, and a follower of the Cyrenaic school, he lived at the court of Cassander, king of Macedonia. Euhemerus was the author of a Sacred Register, in which he tells

how, having been sent by Cassander to the Indian Ocean, he landed in the mythical island of Panchaea. Here he discovered, inscribed on a golden pillar in a temple of Zeus, a history of the world, the study of which led him to the conclusion that the gods and heroes were nothing but supermen, on whom divine honours had been bestowed after death. These ideas survive in the modern term Euhemerism. His writings were translated into Latin by Ennius, and fathers of the church made use of them as arguments against paganism.

Eulenspiegel, TILL. Name of a peasant to whom were ascribed the jests and practical jokes in a popular Low-German collection of the late 15th century (now lost). The High-German version, the basis of all subsequent editions, was printed in 1515. Eulenspiegel is supposed to have been an actual person, who died in 1350, and his traditional grave is shown at Mölln. His story was widely popular in Europe and in England, and is the theme of an epic novel by the Flemish writer, de Coster (1868), and the basis of a symphonic poem by Richard Strauss (1895). See Tyll Owlglass.

Euler, LEONARD (1707-83). Swiss mathematician. Born at Basel, April 15, 1707, he became professor of mathematics at St. Petersburg, 1733, and at Berlin by Frederick II's invitation, 1741, returning to Russia in 1766. He died there Sept. 18, 1783. He was an accomplished mathematician and prolific writer, doing valuable work in mathematical analysis in revising and coordinating the existing branches of pure mathematics, and in a study of planetary motions. His name was given to the Eulerian numbers, coefficients of expansion.

Euler-Chelpin, HANS KARL AUGUST SIMON VON (b. 1873). German-Swedish chemist. Born at Augsburg, Feb. 15, 1873, he studied chemistry at Munich, Berlin, and Paris, and in 1898 became a lecturer at Stockholm university. After his marriage to the daughter of a Swedish nobleman he was naturalised Swedish, and during 1906-41 held the chair in chemistry at Stockholm. He specialised in chemistry of plants, especially of moulds, and was director of the biochemical institute and institute for research in organic chemistry. His researches and publications on fermentation were important for the food and pharmaceutical industries, and he was awarded the Nobel prize for chemistry in 1929.

Eumaeus (Gr. *Eumaios*). In Greek legend, the faithful swineherd of Odysseus, to whom his master revealed himself when he arrived in disguise in his native Ithaca after 20 years' absence. Eumaeus afterwards helped Odysseus to slay the suitors of Penelope (*q.v.*). *Pron.* U-mē-us.

Eumenes OF CARDIA (c. 360-316 B.C.). Private secretary to Philip of Macedon and Alexander the Great. He accompanied the latter on his Persian campaigns, and on Alexander's death, in 323 B.C., became ruler of Paphlagonia, Cappadocia, and Pontus. After a four years' struggle with Antigonus (*q.v.*), he was taken prisoner by the latter and put to death. See Craterus. *Pron.* U-men-eez.

Eumenes. Name of two kings of Pergamum. Eumenes I reigned 263-241 B.C., but Eumenes II, who reigned 197-159 B.C., is the more important. Realizing that his interests lay in recognition of the power of the Romans, he entered into an alliance with them, assisted them in the war against Antiochus the Great, taking part in the battle of Magnesia, and was established by them as ruler of Mysia, Lydia, Phrygia, Lycaonia, and Pamphylia. His lukewarmness in the war against Perseus, king of Macedonia, caused him to be suspected of intriguing with the enemy, and he never completely regained Roman favour. Under his rule Pergamum became a city of great magnificence. Eumenes founded a library said to rival that of Alexandria. See Pergamum.

Eumenides OR ERINYES. In Greek mythology, avenging deities who pursued those guilty of crime, especially crimes against the family and crimes of bloodshed. They are represented as winged women with snakes sprouting from their heads instead of hair, and bearing torches and scourges. They were three in number—Tisiphone (avenger), Alecto (unceasing, relentless), and Megaera (jealous). Erinyes was the older name, Eumenides (the kindly) being a euphemistic title, bestowed upon them after they had abandoned their persecution of Orestes. In Attica they were by preference called Semnai, the awful goddesses. They were propitiated by wineless libations of water, milk, and honey. Furiae and Dirae were the Roman equivalents. *Pron.* U-meni-deez.

Eumenides. Tragedy by Aeschylus, last of the trilogy Oresteia. The subject is the trial of Orestes before the Areopagus (*q.v.*) for the murder of his mother, Clytaemnes-

tra. The Erinyes act as prosecutors, and Orestes, who is defended by Apollo, is acquitted by the casting vote of Athena. The play ends with a panegyric of Athens and its venerable court of justice, and the Erinyes are propitiated by their name being changed to Eumenides. See Agamemnon; Choephoroi.

Eumolpus (Gr., sweetly singing). In Greek mythology, son of Poseidon, the sea-god, by a mortal mother, Chiōnē, who, in remorse, threw the infant Eumolpus into the sea. He was saved by Poseidon, and after many adventures reached Attica, where he perished in a war with Erechtheus, the Athenian king. He was credited with being the founder of the Eleusinian mysteries, and his descendants, the Eumolpidae, were priests at Eleusis throughout the history of ancient Greece.

Eunuch (Gr. *eunē*, bed, *ekhein*, to keep). Word originally applied to a man in charge of the women's apartments in Oriental countries, but afterwards to a castrated attendant in the harem. The custom of entrusting women to eunuchs has prevailed in the East since Babylonian times, and was imitated by the later Roman emperors. These eunuchs frequently acquired great power and high position. In modern times lads were castrated in order to preserve their clear boyish voices. Italian churches employed *castrati* in choirs, but Leo XIII abolished the practice in 1878. From time to time religious fanatics have undergone self-mutilation, the Skoptsi, of Russia, being notable examples. The only Christian self-castrate of note was Origen.

Euonymin. Extract of the bark of *Euonymus atropurpureus*, the spindle-tree of the U.S.A. It is useful for constipation associated with disturbance of the liver. See Spindle Tree.

Eupatoria OR YEVPATORIA. A seaport and industrial town of Ukraine S.S.R., on the W. coast of the Crimea at the N. end of Kalamita Bay, 40 m. N.W. of Simferopol. Its Tartar name was Gyuzleve, Russian Kozlov. In 1783 it was taken from the Tartars by the Russians, who renamed it Eupatoria, after the ancient town founded by Mithradates VI the Great, King of Pontus. In 1855-56 Eupatoria was occupied by Anglo-French troops. Bombed by the Germans during the assault on the Crimea, Eupatoria was evacuated by the Russians in Oct., 1941, and in Jan., 1942, was vainly attacked by them. It was recaptured from

the Germans by units of the 4th Ukrainian army on April 13, 1944. The town contained a Karaite Jewish synagogue, a mosque on the plan of S. Sophia, Istanbul, and a Greek Catholic cathedral. It has meat-packing factories, flour and clothing mills, and exports salt. Pop. (est.) 23,000.

Eupatridae (Gr. *eu*, well; *patēr*, father). Nobility of Athens and Attica, supposed to be descended from the ancient heroes. The rest of the inhabitants were roughly divided into Geomori or farmers, and Demiurgi or artisans and traders. As the kingship declined, the influence of the Eupatridae increased until they virtually governed the state. Their influence was checked by Draco's code of laws, providing for the administration of justice equally among all classes, and ended by the constitution of Solon. See Draco; Solon.

Eupen. District and town of Belgium. The territory known as the Kreis (circle) of Eupen lies S. of Aix-la-Chapelle (Aachen), and covers an area of 400 sq. m., with a pop. of about 60,000. It is fertile, with rich pastures and meadows, and its chief industry is dairy farming. It contains Eupen, Raeren, Kammersdorf, and Conzen. The town, the administrative centre of the Kreis, has a pop. of about 13,500. It is on the Weser, 10 m. S. of Aix-la-Chapelle, and makes woollen goods, paper, soap, and machinery. It has iron-foundries, breweries, and tanneries.

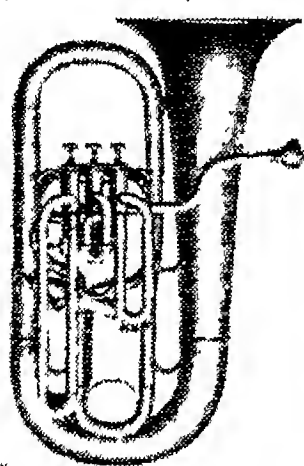
Formerly part of the duchy of Limburg, Eupen was under the government of Austria until 1801, when by the peace of Lunéville it passed to France. In 1814 it was given to Prussia, later forming part of the Rhine province until 1919. By the treaty of Versailles, Germany renounced in favour of Belgium all rights and title over the territory comprising the whole of the circles of Eupen and Malmédy. Belgian troops occupied Eupen on May 26, 1919, taking it over from the French. The Germans occupied Eupen on May 10, 1940, the day they invaded the Low Countries; and the town was reincorporated in the Reich on May 18. It was liberated by armoured units of the U.S. 1st army, Sept. 11-12, 1944, and restored to Belgium. *Pron.* oy-pen.

Euphausiacea. Order of crustacea (*q.v.*) containing only a few genera. Together with the dactopoda (the large order containing lobsters, crabs, etc.) they make up the group called the eucarida in which the carapace fuses with all the

thoracic segments, forming the familiar solid covering of *e.g.* the crab. Most euphausiaceans are about the size of large prawns. They form the food of the great whales which in their turn provide man with huge supplies of oil and fats. They are plentiful in the S. Polar seas, and much work has been done on their ecology in relation to the whale fisheries, for instance by the Discovery expeditions.

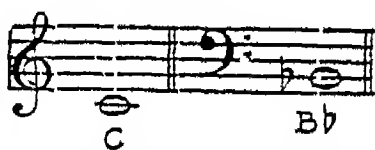
Euphemism (Gr. *eu*, well; *phēmē*, voice). Substitution of refined and delicate words for coarse and vulgar words conveying the same idea. The object is to disguise as far as possible painful or unpleasant subjects which yet must be referred to. In English literature the device was widely over-used in the Victorian era, when gentility required that the term "unmentionables" should replace "trousers," "nether limbs" disguise "legs," etc. Later writers have tended to abandon this practice. By extension, the term is applied to an expression such as "passed away" for "died," which is intended to mitigate the austerity of a simple statement.

Euphonium (Gr. *eu*, well; *phōnē*, sound). Brass wind instrument of the saxhorn family. Of



Euphonium,
4-valve instrument
By courtesy of
Hawkes & Co.

bass pitch and tone, it is of the same pitch as the baritone saxhorn, but its bore is wider and tone fuller. The euphonium is the chief bass solo instrument in military bands, and often doubles the melody an octave below the cornets. It also plays bass parts with the heavier bass instruments, bombardon, bass tuba, etc. Euphoniums are made in C and B flat, both played as non-transposers. In brass bands the B flat euphonium is sometimes written for on the treble stave, when it becomes a transposer, and the notes are placed a major ninth higher. *i.e.*



The open notes of the B flat instrument are:



and its three, four, or five pistons complete the scale, and give a chromatic compass of over three octaves.

Euphorbiaceae. Large family comprising trees, shrubs, and herbs. They mostly possess milky juice



Euphorbiaceae. Two species: left, sea spurge; right, dwarf spurge

and grow in all parts of the world except the Arctic zones. The leaves are all undivided, and either alternate or opposite. The sexes are always in separate flowers without petals. About 3,500 species are known, including spurges, mercury, cassava, castor-oil plant, croton, hevea (producing rubber), etc. Preparations of *Euphorbia peplus* and *E. pitulifera* are sometimes used in medicine, to relieve conditions associated with difficult breathing. The order is named after a Greek physician, Euphorbus (1st century B.C.). The box and a few allied genera formerly included in the Euphorbiaceae, now form a distinct family, the Buxaceae.

Euphorbus. In Greek mythology, a Trojan hero slain by Menelaus. Pythagoras, who taught the transmigration of souls, believed that he himself had once been Euphorbus, and in proof he unhesitatingly identified the shield of Euphorbus in the temple of Hera near Mycenae as his own.

Euphrates. The western river of Iraq, flowing over the alluvial plain to join the Tigris and enter the Persian Gulf. One of the notable rivers of antiquity, the joint valley was the home of the earliest civilization. The river, called Frat by the Turks, rises in N.E. Turkey, about lat. 40° N. The parent streams, the Kara Su and the Murad Su, originate well over 1 m. above sea level. Both flow at first west between snow-capped ridges; the Kara Su crosses the plain of Erzerum, and is a big river, 200 ft. in width; it breaks through the southern ridge by a series of rapids, receives the Murad Su at Keban Maden, flows still W. and then breaks through a second ridge by a long, narrow gorge, to enter the Malatia plain at a level of about 2,600 ft. The

Murad Su, which rises near Mt. Ararat, has a wilder course than that of the Kara Su, and receives greater quantities of melted snow.

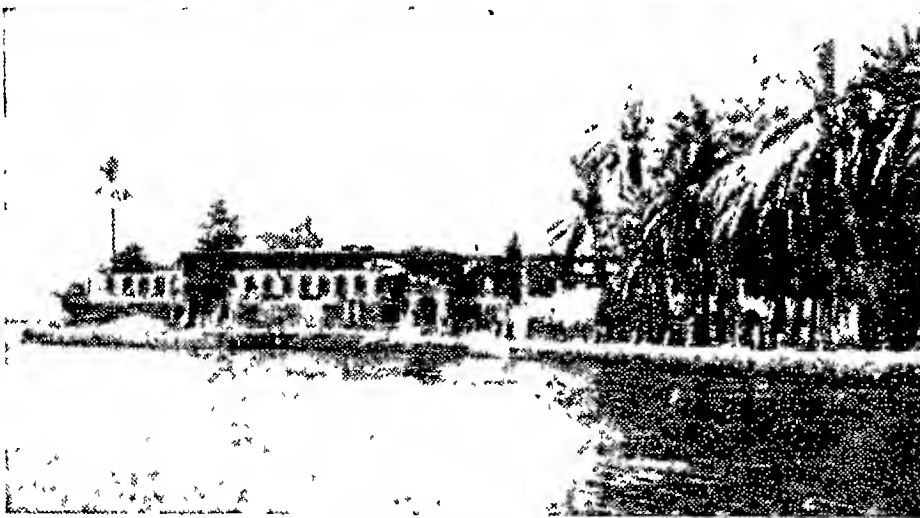
From the plain the Euphrates has a rocky course through the Tauric mts. to Samsat, falling 1,500 ft. in about 100 m., to emerge on to the lowland and fall 1,000 ft. in 1,800 m., a broad, majestic stream crossed until quite recently only by primitive ferries. In the neighbourhood of Aleppo, Syria, the river is but 80 m. from the N.E. corner of the Mediterranean Sea, but almost immediately turns definitely S.E. on its way to the Persian Gulf. The lowland course is in a sandy trough, comparable to that of the Nile in Egypt; a narrow bordering strip is cultivable by the use of river water; it receives only one important tributary, the Khabur, and consequently decreases in volume by excessive evaporation.

During hot summers it becomes fordable; nearer Kurna, where it joins the Tigris, it percolates into marshes, losing still more water. The combined stream is the Shatt-el-Arab. The Euphrates has no large modern town on its banks, but ancient Babylon was beside the river. The stream is navigable for small craft to Birejik on the caravan route to Syria. Its total length is about 1,700 m.

Euphuism (Gr. *euphuēs*, clever).

Name given to the artificial style in which John Lyly (*q.v.*) couched his famous romance. Euphuës, the Anatomy of Wit, 1579, followed in 1580 by Euphuës and His England. The characteristics of this "new English" were the balanced antithetical sentences marked by elaborate alliteration, the excess of classical allusion, and the extravagant drafts upon natural history for purposes of moral reflection. The high artificiality of euphuism carried the seeds of decay within it, and it died before the 16th century was out. Scott claimed to have modelled Sir Piercie Shafton in The Monastery on the euphuistic fashion which prevailed for some years.

Eupolis (d. c. 410 B.C.). Athenian comic writer. He was a con-



Euphrates. Tomb of Ezra near Kurna, at the junction of the Euphrates and the Tigris

temporary of Aristophanes and Cratinus, with whom he was associated by Horace and others as one of the chief representatives of the old comedy. Among his comedies, of 12 of which fragments remain, were Kolakes (the Flatterers), ridiculing the wealthy Callias, a patron of learning; Marikas, an attack on the demagogue Hyperbolus (*q.v.*), represented as a slave; Dēmoi, lamenting the unhappy condition of the state under the encroachments of democracy; and Baptae (the Dippers), an exposure of the licentious practices of Alcibiades.

Eurasian. Term originally denoting the offspring, and their descendants, of a European father and a Hindu mother. It was formed out of the continental names, about 1820.

The term now denotes any European and Asiatic hybrid; and, in geography and ethnology, characters common to both continents.

Eure. River of France. It rises in the dept. of Orne and flows through the depts. of Eure-et-

wheat is grown. Horses, sheep, and cattle are reared, a great deal of fruit is cultivated, and the peasants export butter and eggs. The Seine borders the dept., which is also drained by the Eure, Rille, and other tributaries of that river. Évreux, the capital, Elbeuf, Les Andelys, Bernay, Verneuil, and Louviers are the chief towns. Before the Revolution, most of Eure was in Normandy. Area 2,330 sq. m. Pop. (1954) 332,514.

Eure-et-Loir. Department of France. An inland dept. in the N.W. of the country, it is flat and fertile in the S. and E., but less so in the N. and W. The former is included in the plain of Beauce, while the latter is known as the Perche and the Thimerais. The chief rivers are the Eure, Loir, and their tributaries. The most important products are wheat and oats. Apples are grown, while cattle, sheep, and horses are reared. Chartres is the capital, and Dreux and Châteaudun are other towns. Before the Revolution the dept. was partly in Normandy and partly in Orléanais. Area 2,291 sq. m. Pop. (1954) 261,035.

Eureka (Gr. *heurēka*, I have found). Exclamation of Archimedes (*q.v.*), when he ran naked from his bath through the streets of Syracuse after discovering a method of detecting the alloy in the gold of Hiero's crown.

Eureka. City of California, U.S.A., the co. seat of Humboldt co. It stands on Humboldt Bay, 284 m. N.W. of San Francisco, and is served by rly. and airport. A port of entry, it is engaged in shipping lumber, obtained from the redwood forest region in which it is situated. It has fisheries, and also ships dairy and poultry produce. Settled in 1850, it was incorporated in 1856. Pop. (1950) 23,058.

Eurhythmics (Gr. *eu*, well; *rhythmos*, measured motion). Art of expressing harmony by gestures.



Loir and Eure to the Seine, which it enters near Pont de l'Arche, not far above Rouen. Its length is about 70 m. and Chartres is the chief place on its banks.

Eure. Department of France. In the N.W. of the country, it is a fairly level area, and the soil is fertile. Much of it is covered with forest, but elsewhere



Eurhythmics. Two attitudes in a plastic exercise in this rhythmic method of physical training

in which physical movement is made to reflect musical notation. It was invented by Émile Jaques-Dalcroze (*q.v.*). Time is shown by movements of the arms and notes by movements of the feet. The unit is the crotchet, which is indicated by a single step, longer or shorter notes being shown by a step with one foot and movements with the other. Exercises for both arms and feet relate to syncopation, phrasing, etc.

The London School of Dalcroze Eurhythmics, used by the ministry of Education as an official training college for teachers of the art, is at Liphook, Hants.

Euripides (480–406 B.C.). Athenian tragic dramatist. According to tradition, he was born on the



Euripides,
Greek dramatist

island of Salamis on the day of the great naval victory over the Persians. A pupil of the sophist Prodicus, he seems to have been at first intended for a professional athlete, and secondly, for a painter, but soon took to writing for the stage. In 455 B.C. he exhibited his first tragedy, and in 441 gained the first prize for the first time. The last few years of his life were spent at the court of King Archelaus in Macedonia, where he died.

Euripides was credited with over 90 plays in all, of which 18 survive. He gained the first prize only five times, his contemporaries apparently regarding him as inferior to both Aeschylus and Sophocles and other dramatists. His vogue increased, however, after his death, and though never the favourite of the critics, he has been the favourite dramatist of many of the world's poets, notably Virgil, Horace, and Milton. Euripides is undoubtedly a master in the handling of the tender and the pathetic. Aristotle truly called him "the most tragic" of the poets. A reputed misogynist he has yet portrayed women as fine as any to be found in all literature. As a playwright also Euripides stands high; there is an excitement about his plots and a vividness in his situations, although they sometimes verge on the ridiculous, which are lacking in the plays of Aeschylus and Sophocles. Euripides is, in fact, the most human of the three dramatists, and this quality of humanity accounts for his greater popularity

in subsequent ages. Among the blemishes of his art may be mentioned his artificial prologues and his too frequent use of the *deus ex machina* (*q.v.*) or divine intervention in unravelling a plot.

The extant plays of Euripides are: *Alcestis*, *Medea*, *Hippolytus*, *Hecuba*, *Andromache*, *Ion*, *The Suppliants*, *Heracleidae*, *The Mad Heracles*, *Iphigenia among the Tauri*, *The Trojan Women*, *Helen*, *The Phoenician Maidens*, *Electra*, *Orestes*, *Iphigenia at Aulis*, *Bacchae*, *Cyclops*, the last being the only extant specimen of a satyric drama. The *Rhesus* is certainly spurious. Of the plays perhaps the best are *Alcestis*, notable for its exquisite delineation of woman's devotion; *Hippolytus*, the tragic story of the illicit love of Phaedra, a plot used by Racine in his



Europa. The story of Europa depicted by Paolo Veronese
Doge's Palace, Venice

Phèdre; and *Bacchae*, a brilliant glorification of the worship of Dionysus or Bacchus. The plots of Euripides were all drawn from the old mythology, yet the characters are not cast in heroic mould, but act and talk like Athenian men and women of his time. Euripides was accused by his contemporaries of endeavouring to undermine faith in the gods and in morality, and for this supposed tendency, as well as for his alleged bad art, he was bitterly attacked by Aristophanes. See Greek Literature. *Pron.* U-rippi-deez.

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Euripus (Gr. *euripos*). General name for a narrow channel, specially applied to the strait

between the island of Euboea and the mainland of Greece. See Chalcis.

Euroclydon (Gr. *Euros*, east wind; *klydōn*, wave). Name given in Acts 27, v. 14, to the gale which, blowing off Crete, seized the ship in which S. Paul was wrecked on the coast of Malta. The form adopted in the R.V. is *Euraquilo*, meaning a tempestuous N.E. or E.N.E. wind of the Mediterranean.

Europa. In Greek mythology, daughter of Agenor, king of Phoenicia. While she was playing one day with her maidens, Zeus appeared in the form of a white bull, and Europa was induced to mount on the animal's back. The bull thereupon carried her off over the sea to Crete, where by Zeus she became the mother of Minos, Rhadamanthus, and Sarpedon.

She was worshipped under the name of Hellotis in Crete.

Europa. German liner. Built at Hamburg by Blohm and Voss, for Norddeutscher Lloyd, the *Europa* was a sister ship of the *Bremen* (*q.v.*) and was launched in 1928, but damaged by fire and not completed until 1930. She displaced 51,650 tons on a length

of 940 ft. and a beam of 101 ft.; eight triple sets of turbines allowed a speed of 26.5 knots. On her maiden voyage to New York she set up a new record by crossing from Cherbourg to Ambrose Light in 4 days 17 hours 6 mins.; in 1932 she bettered her own record by 3 hrs. 15 mins. In 1935 this time was beaten by the French liner *Normandie*. Throughout the Second Great War the *Europa* was laid up at Bremerhaven; in 1945 the U.S. govt. took her over for use as a troopship; and in 1946 she went to the Compagnie Générale Transatlantique and was renamed *Liberté*. On Dec. 8 that year she sank in Havre harbour. Raised in April, 1947, and re-equipped, she sailed anew in 1950.

Europa Point. Headland at the extremity of the peninsula of Gibraltar, Spain, just S.E. of Europa Bay. To the N.W. is Little Europa Point and to the E. Great Europa Point. Europa Bay is a small circular inlet in the S.W. coast of the peninsula just S. of Shingle Point.

EUROPE: ITS GEOGRAPHY, CULTURE, HISTORY

E. STERN-RUBARTH, A. D. INNES and G. P. GOOCH, D.Litt.

Europe, in many respects of climate and other natural features the most favoured of the land masses of the earth, for a number of centuries dominated the world, both militarily and economically. Its rise, its long period of power, and its disruption by wars are here described. For the story of Europe after 1945, see N.V.

Europe, smallest but one of the earth's continents, takes its originally Greek name from the Semitic word *ereb*, dark; it is the Occident, as compared with the Orient of Asia. In fact it is a huge peninsula of the greatest continent, Asia, with which it forms Eurasia—a term meaning the Old World in comparison with the New, *i.e.* American, hemisphere. The borders between Europe and Asia are conventional ones determined neither by a clear-cut difference in physical conditions, nor by a racial or linguistic distinction. Europe covers just over 4 million sq. m., with about 500 million inhabitants.

Its outstanding physical characteristic is the deep inroad made by the sea into its surface. This produces a coastline with a length of 23,250 m., slightly longer than that of Africa. This coastline embraces a dozen peninsulas, of which the most extensive are Scandinavia, Finland, Kola, in the N., and the Iberian, Balkan, and Italian peninsulas in the S.

Influence of Sea on Climate

These inroads of the sea into the land also affect the climate of Europe, which is dominated virtually all over the continent by oceanic air currents and temperatures; and while Europe's greatest distance W. to E. is 3,150 m., and N. to S. nearly 2,500 m., the furthest inland city (Sverdlovsk in the Urals) is only 800 m. from the sea, and excluding Russia, only a fraction of that distance. The coast is surrounded by islands which link it, in the S.E. with Asia by the Greek archipelago, in the S. with Africa by Sicily, in the N.W. with America by the British Isles. The narrow strip of the Bosphorus, and the 10½ m. strait of Gibraltar separate it from Asia and Africa respectively. The 100-fathom line runs from the Spanish coast to the Bay of Biscay and from there sweeps around the British Isles to the S. of Norway, whose rugged coast drops deep into the sea; including the comparatively flat and shallow North and Baltic Seas, the continent of Europe, together with its submerged parts, is therefore considered as stretching to beyond the W. of Ireland.

Physically, Europe is the continent with the lowest average altitude—1,000 ft., against *e.g.* 3,200 ft. over Asia; plains, up to 650 ft., cover 60 p.c. of its surface; its highest mountain range, the Alps, reaches 14,600 ft., the Carpathians 8,100 ft., the Gran Sasso in Italy nearly 8,900 ft., the Mulahacen in the Sierra Nevada 10,600 ft., and the Pic d'Aneto in the Pyrenees just under 10,400 ft. A great variety of other mountains have peaks of 4,000–7,000 ft.; as watersheds, they account for the fluvial system.

Rivers and Canals

Its greatest rivers flow across the plains of the E., the principal one being the Volga with a length of 2,500 m., followed by Dnieper, Don, and Dvina. Europe's second longest river, the Danube with 1,780 m., has wound its way through mountain ranges. With the Rhône, the Po, and the Rhine, it belongs to the Alpine watershed, though the mouths of these rivers are far apart. The Vistula, Oder, and Elbe, three great central European rivers, have likewise the area of their sources in common, between the Tatra and the Sudeten Mts.; the same applies to most Spanish rivers. As most of the navigable rivers from the French Atlantic coast to the Gulf of Finland cross the plains in a slow and steady flow, they have been linked by a network of canals which, in France, connects Atlantic with Mediterranean; in Germany, North Sea with Baltic, North Sea with (via Danube) Black Sea; in Russia, Caspian with Arctic and Baltic, Baltic with Black Sea.

GEOLOGY. The oldest parts of the continent are in the N. and extreme W., from Ireland to Finland, consisting mainly of igneous Archaean rock. The huge E. plain which covers European Russia, Poland, Denmark, N. Germany, and the Low Countries is the result of erosion from the mountains in the S., and glaciation in the N., during the Diluvial period. All folds S. of the belt of Archaean rocks are considered as consequences of a process which started during the Mesozoic, and reached its climax during the Tertiary period. Folded mountains arose, either by tectonic pressure,

or by the eruption of huge masses of magma; the latter in particular accounts for the mountains of W. Scotland, the French central massif, the Eifel W. of the Rhine, and the Bohemian mountain chains. Farther south however, frequent earthquakes and volcanic eruptions produced folds of great length, by lateral pressure (this process has not entirely died down, as indicated by continuing volcanic activity—Vesuvius, Etna, Lipari Islands) and, by counteraction, created simultaneously deep grooves and plains, such as the Hungarian Alföld and the plains of the river Po. The latest tectonic transformation took place during the Diluvium, when the Baltic and North Seas came into being by slow subsidence of their soil, and Asia and Africa were separated from Europe. During that period all N. Europe inclusive of the British Isles was covered with ice, while the approaches of the high mountains were penetrated by glaciers such as still remain in the Alps. In the neighbouring plains the diluvial deposits—moraines, sand, etc.—mostly determine the character of the soil, and to some extent the climate.

Rich Variety of Minerals

This great variety of geological transformation to which Europe was subjected accounts for its comparative wealth in minerals. It yields iron ore in Sweden, Britain, France, Germany, Austria, and Russia; zinc in Britain, Italy, and Germany; tin in Britain and on the Czech-German border; lead in Britain, Spain, Czechoslovakia, and Germany; copper in Britain, Sweden, Russia, and Germany; platinum, gold, and silver in the Urals, the last two also in the Carpathians; mercury in Spain and Carinthia. Coal is widely distributed, but particularly in Britain, Belgium, Germany, and S. Russia. Petroleum is found in Rumania, Poland, Russia, and to a smaller extent in Austria, Hungary, Hanover, and Alsace. Bauxite comes mainly from France, Hungary, and Switzerland. Many rare radio-active elements have considerable deposits on European soil.

The tectonic origin of Europe's surface produced a number of

lakes, most of which, however, were the results of the diluvial floods. The largest are Ladoga with 7,100 sq. m.; Onega, 3,600; Wener, in Sweden, 2,200; Wetter, likewise in Sweden, 730; Balaton, in Hungary, 250; Geneva, 225; Constance, 205 sq. m. Other remnants of the great flood still exist as swamps in Russia, along the Pripet river and near the Caspian, but most are subjected to systematic drainage.

CLIMATE. Except for its arctic N., Europe belongs to the moderate zone of climate; but it enjoys a milder temperature than would normally exist at its latitude. The Gulf Stream affects its W. and N. coasts, and W. winds prevail. Also the E.-W. direction of all important mountain ranges does not put obstacles in the way of the warm streams of oceanic air, which penetrate deep into the E. As a result the Norwegian coast is 35° F. and the Baltic is 22° F. warmer in the winter than the world average for corresponding latitudes. The same applies to the N. of Scotland—35° F. above the average in Jan.—and, with a decreasing curve, to all parts near the W. and N.W. shores. The 32° F. isotherm, which limits the area frostbound during the winter, runs from the North Cape through Hamburg, the Alps, the Balkans, the Crimea, to S. of the Caucasus, which separates Europe from Asia. In summer, temperatures are normal for the latitude.

The rainfall exceeds 60 ins. annually on the highest areas and on parts of the W. coast. The Pyrenees, Alps, Balkans, and Caucasus include districts where the rains exceed 40 ins., but most of Europe has an annual precipitation of between 20 and 40 ins. Spain and E. and N. Russia receive less than 20 ins. The Mediterranean peninsulas are lands of clear skies with a maximum duration of sunshine in excess of 2,500 hours annually. Scandinavia is a cloudy area with less than half as much sunshine.

VEGETATION. European flora is largely the result of its geological development. During the Tertiary period the soil was covered by tropical and subtropical vegetation; in the Diluvial period it was covered by arctic plants still found in the higher mountain ranges; and when the ice vanished, other plants, mainly from the E., immigrated with the increasing warmth and humidity. There are now four clearly distinguished

zones of vegetation: the Arctic, with treeless tundra carrying moss, lichen, and rampant shrubs; the Central European pine and leafy woods, with summer-green meadows; the Mediterranean belt, with evergreen plants and tropical palms; and the S. Russian grass steppe, branching off into Hungary.

Economic plants are the olive tree, in Greece, Italy, and Spain; vine up to about 50° N.; wheat to about 60° N. (in specially vernalised varieties, much farther N.); rye to nearly 70°; maize in Rumania, Hungary, Italy, and N. Spain; oranges, figs, and other fruits, mainly along the Mediterranean and in Portugal. Trees range from plane, chestnut, and cork-oak in the S. to beech, oak, and lime in the central zone, birch and pine in the N.

Dairy farming and cattle breeding are spread over nearly the whole continent. The fauna of Europe, except for birds and small animals, is not so much the result of climate and geology as of man's influence, which eliminated most of the larger wild animals not qualifying for domestic exploitation.

POPULATION. Europe's inhabitants can be placed roughly in three large main linguistic or racial groups: Latin, Germanic, and Slavonic. Embraced by both the former are the small remnants of the Celts; by the latter those of the Balts. Finns and Hungarians, Greeks, Albanians, Turks, Basques, some Jews, and gypsies belong to none of the three main groups which, together, represent 90 p.c. of Europe's population. The number of different languages is about 70, half spoken by at least one million people each, 13 of them within European Russia; the other half together by only 8 millions. See table p. 3179.

Religions of Europe

The religious grouping shows more than 96 p.c. Christians, of whom Roman Catholics with 44 p.c. (in the Irish Republic, France, Spain, Portugal, W. and S. Germany, Italy, Austria, Hungary, Poland) are the strongest numerically. Protestantism, with 28 p.c., is dominant among the Germanic peoples, Finns, Estonians, Letts, and in parts of Czecho-Slovakia and Hungary. The Orthodox churches count about 25 p.c. among the Eastern Slavs, Greeks, Rumanians, and other Balkan nations. There are about 12 million Mahomedans; and some 2 million Jews (some 9.6 million before 1939).

After the Second Great War (treating Germany as one national unit) Europe held within its

STATES OF EUROPE, 1957, IN ORDER OF POPULATION

European Russia
Germany
United Kingdom
Italy
France
Spain
Poland
(Rumania
(Yugoslavia
Czecho-Slovakia
Netherlands
Hungary
Belgium
Portugal
Greece
Bulgaria
Sweden
Austria
Switzerland
Denmark
Finland
Norway
Irish Republic
Turkey-in-Europe
Albania
Luxemburg
Iceland
Monaco
Liechtenstein
San Marino
Andorra
Vatican City

boundaries seven large states, with over 20 million inhabitants each; 11 medium ones, with between 5 and 20 millions each; nine small ones, with below 5 millions; and five midget states, with under 100,000 each. In extent of territory, however, Sweden ranks fourth among the great powers (above Germany); Finland and Norway sixth and seventh respectively, above Poland; Iceland 16th, above Hungary; and the Netherlands and Belgium, between Switzerland and Albania.

Virtually none of these European nations has a completely homogeneous population. In Switzerland the largest part speaks a German dialect, two smaller ones French and Italian, and a fraction Romansch. Belgium is split between the French element of the Walloons and the Germanic Flemings. France has Germanic Flemings and Alsatians, Celtic Bretons, and Basques. Great Britain has Germanic, Celtic and older elements. Germany has Nordic, Dinaric, and Alpine peoples, and Slavonic remnants; Italy, Lombardian and Moorish strains; while Russia, dividing its European people into Great Russian, Ukrainian, and White Russian, contains partly Asiatic populations. In Spain are Iberian and Celtic elements, infiltrations of Germanic Goths, Vandals, and Semitic Moors and the larger part of the remaining aboriginal Basques.

The density of population, indicative likewise of the state of civilization and economic activity and prosperity, varies widely. A belt of the densest population, with over 250 per sq. m., reaches from Lancashire and Yorkshire, through London, the Netherlands, and Belgium, along the Rhine to the Alps, through the centre of Germany (Thuringia, Saxony), S. Poland, deep into the industrial area between Kiev and Stalingrad. An extension runs S. of the Alps from Lombardy through the Italian peninsula to Sicily. Along these belts are situated all the areas of densest population, with more than 500 inhabitants per sq. m.

Apart from the mountainous districts—the Scottish Highlands, Pyrenees, Alps, Carpathians, etc.—and large parts of the Scandinavian peninsula, areas with fewer than 20 inhabitants per sq. m. are found only in N.E. Russia, around the Caspian, in Finland, and on the Spanish plateau (which became sterile in consequence of senseless and radical deforestation in the Middle Ages).

How Religion Affected Civilization

European civilization and culture are, to a large extent, linked with religious development. Springing from the Mediterranean (Greece and later Rome), civilization shifted its centre slowly, first to the Romance countries until, in the Middle Ages and later, the Germanic nations came to share it, while the E. Mediterranean and the adjacent Balkans lost their predominance, largely after conquest by the Turks. The E. of Europe, partly because of its Orthodox Church with Byzantine influence, and the influx of Asiatic populations, developed a civilization independent of the general European one. The comparatively high degree of European culture is largely the result of its great variety of conditions. Its numerous geographical sectors have easy access one to another, and this exchange has prevented localised stagnation. The general standard of education is highest in the N. and N.W., lowest in the E. and Spain, though in Soviet Russia the number of illiterates is rapidly dwindling.

INDUSTRY. The belt of densest population is identical with Europe's main economic arteries. Agriculture, favoured by the large extent of the plains and the comparatively mild climate, continues to play a primary part in Europe's economic life, while the incomparable coast has made fishing more significant than on any other

continent. Industrial development, based upon the exploitation of large coalfields, took place in the course of little more than the 19th century. Apart from the zones of densest population mentioned, main industrial centres are the heart of Sweden, the Rhône valley, Catalonia and the Basque N. of Spain, and a few big cities, *e.g.* Paris, Berlin, Hamburg, Warsaw, and Moscow.

Gradual Exhaustion of Natural Resources

Between these and other parts of the continent there is an exchange of raw materials and finished goods, although the exploitation of Europe's natural resources, especially ores, has long reduced the available quantities so as to make imports from overseas a necessity. Iron ore, for many European countries, comes mainly from Sweden and Spain, but gold, silver, copper, and mineral oils mainly from outside Europe. The continent's proportion in the world production of coal, iron, zinc, and lead is rapidly dropping, partly because of greater American and Asiatic Russian output. Europe mined 60 p.c. of the world's coal in 1900, but only 45 p.c. in 1929. For steel the corresponding figures are 65 p.c. and 35 p.c.

Industrial development in specific areas is due to historical factors like the transformation of domestic crafts into mass-production. Thus, specialised textile industries are found in Lancashire, N.E. France and Belgium, S. of the Ruhr in Krefeld and Wuppertal, in Saxony, Czecho-Slovakia, Austria, Switzerland, N. Italy, in Lyons (for silk), in Lodz, and around Barcelona. Glassware and ceramics flourish in Britain, Belgium, Thuringia, and Bavaria, Czecho-Slovakia, and along the German-French borders. Electrical and chemical industries, comparatively independent of proximity to heavy raw materials, have developed in or near London, Manchester, Paris, Marseilles, Berlin, Cologne, Frankfurt-on-Main, Mannheim, Halle, Zürich, Milan, Vienna, Prague, Brno; the same applies to motor car, optical, photographic, and other industries. Watches are a speciality of Switzerland; before the Second Great War, toys were a speciality of Nuremberg and Thuringia; clocks of S. Germany; women's fashions originate in Paris, sports equipment in Great Britain, etc.

In order of industrial development the countries can be listed as follows: Great Britain, Belgium, Germany (pre-war), France, Italy,

Switzerland, Czecho-Slovakia, Austria—these last two forming a transition from the agrarian to the industrial state; the Netherlands and Norway, important trading, if not industrial, countries; Spain and Sweden, exporters of raw materials and foodstuffs; Poland, with coal, zinc, and timber, and Rumania, with petroleum, agrarian countries with less developed industries. The Balkan states, Portugal, and Eire are countries whose economic life is based exclusively upon agriculture. European Russia, though building large industries since about 1925 on a Communist basis, is still essentially dependent upon farming and forestry.

COMMUNICATIONS. Europe's geographical structure and position in relation to other land masses favoured its growth as a world centre of communications. Transport throughout the continent itself benefited from the many navigable rivers, the wide plains, and the early rise of chains of settlements, and Europe possesses a close network of highroads and railways, insufficient only in the E. and S.E. The Danube, Vistula, Volga, Elbe, Rhine, and Loire, and to a lesser degree the Oder, Weser, Seine, serve as national, and some of them as international, waterways, and are interlinked by canals. They connect great ports whose prosperity was made possible by the many secondary seas penetrating into the continent. Most of the chief ports face the Atlantic: Hamburg, Bremen, Rotterdam, Antwerp, Southampton, Liverpool, Glasgow, Cherbourg, and Bordeaux. Others serve the Mediterranean, and include Marseilles, Barcelona, Genoa, Trieste, Brindisi, and Piraeus.

The European railway network, thickest in Belgium and next to that in Great Britain, covered, before the Second Great War wrought havoc upon it, just over 250,000 m.

European Air Lines

Motor highroads, a comparatively new feature, facilitated the development of large-scale road haulage in the central and W. parts of Europe. Air lines on schedule were inaugurated in 1919 and rapidly augmented; they serve for the rapid transport not only of passengers, but of valuable or perishable goods as well. By the middle of the century regular routes flown in Europe (including European Russia) covered 300,000 m., and total mileage flown in a year by aircraft under schedule

was 150 million m., the number of passengers was approx. 9,000,000, and the amount of freight and mail carried by air exceeded 100,000 tons.

ECONOMIC POSITION. Europe, as the sphere or origin of capitalist economy, and of politico-economic colonisation, was in the 19th century the world's economic centre. Its own raw materials, however, proved progressively insufficient for requirements; in foodstuffs, likewise, Europe became more dependent on supplies from overseas, especially from the young colonial territories. In exchange for such supplies, Europe provided the whole world with finished goods and with capital. London, before the First Great War, was the world's money market and its most important wool exchange, while cotton interests looked to Liverpool, furriers to Leipzig, etc. This whole predominance of Europe was undermined by and in consequence of that war, which enriched countries overseas while forcing many hitherto industrially undeveloped ones to create their own factories, and transformed the U.S.A. from a debtor nation into the world's greatest creditor. It opened world markets for American and for cheap Japanese goods. Against such competition, Europe's weakened economic structure had an uphill struggle before the Second Great War.

Reasons for Europe's Economic Decay

The creation in 1919 of a number of small states all bent upon a maximum of independence from neighbours with whom previously they had been economically united; an ill-advised protectionist policy resulting therefrom; and Russia's withdrawal from European capitalist trade, were contributory reasons for the decay of Europe's economic pre-eminence. Attempts at countering these evils by pacific economic unification (see Europeanism) were opposed by Fascism and Nazism, which exploited misery and dissatisfaction in the direction of aggression. These false doctrines completed the downfall of Europe as the continent of civilization, prosperity, and leadership of the world; left it dependent for its food rations, raw materials, and working capital upon loans by the U.S.A. and colonial countries; and, though officially participating in the new United Nations organization, with severely clashing plans, aims, and ideologies among the main powers.

A movement, long rampant, but brought to a climax by the Second

Great War for the complete emancipation from Europe of the colonial peoples, was a consequence as well as a confirmation of Europe's decline (see India, Indonesia, Vietnam, etc.). Independence, if won by amicable arrangement, does not necessarily mean any decrease in the exchange of goods and services, but the political predominance over the rest of the world once possessed by Europe has ceased. Increase of skill, harder work, better scientific and technical equipment, and more nearly perfect organization of European man and his resources, and the example he may thus set in creating a harmonious, satisfied, and civilized community, can alone assure Europe any possible remaining superiority in the world.

Edgar Stern-Rubarth

HISTORY. The continent of Europe with its present contours emerged after the last ice age, probably not less than 20,000 years ago. For untold ages before, the greater part of it had been subjected to Arctic or tropical conditions of varying intensity, so that geologists divide the whole period into a succession of ice ages with non-Arctic intervals between them. Man had existed before the last ice age, but the new Europe was repopulated, not by the descendants of the "drift" men, but by men who, moving from warmer regions, made their way across it as the ice receded. In the course of some thousands of years tribes coming either from the east or out of Africa had spread thinly over the habitable area, settling in communities, acquiring to a limited degree the arts of agriculture, and developing the use of tools and utensils.

The Battle-Axe Folk

It is still not known for certain where the people lived who developed the ancestral Indo-European language. Philologists no longer think that their home was Asia, but place it rather in some area of south Russia or the Hungarian or German plains. Groups of proto-Nordic physical type, with a culture distinguishable by its stone battle-axes and cord-decorated pottery, are known in the Saxo-Thuringian area of Germany about the upper Saale, and in south and south-west Russia, at the end of the Neolithic period, and some scholars favour the view that these are the folk among whom the Indo-European mother-tongue arose; but it is not clear which group, if either, was the parent one. The migrations of the

Battle-Axe folk, however, heralded the beginnings of the Bronze Age in Europe, and the differentiation and spread of the Indo-European languages must have begun about the same time. The Indo-Europeans who made their way across Europe, imposing their language on the peoples already there, are divided into five main groups: Celtic, Italic, Greek, Teutonic, Slavonic.

The Celts, who appear to have consolidated into a distinct ethnic group in and around the upper Rhine and upper Danube, moved from their homeland in a succession of waves in the late Bronze and early Iron Ages, dominating but not exterminating the earlier inhabitants of modern France, the British Isles, northern Spain, parts of Germany, and Bohemia. The Italic group, closely related to the Celts, moved down into the Italian peninsula. The ancestors of the classical Greeks began to make their way down into the Balkan peninsula early in the second millenium B.C. The Teutonic peoples seem to have developed around the Baltic, occupying north Germany and Scandinavia and then pushing the Celts southward, coming into touch with the Romans in the Cimbric War of the late 2nd century B.C. Caesar's conquest of Gaul prevented their permanent advance beyond the Rhine until the great migrations of the 3rd to the 5th centuries A.D. The movements of the Slavonic group came later still.

Beginning of European History

European history may be said to begin with the Bronze Age civilization of Minoan Crete (q.v.), which dominated the islands and coasts of the Aegean Sea. This essentially Mediterranean civilization developed by the Cretans, a Mediterranean people, was adopted by the mixed Indo-European and Aegean inhabitants of the Peloponnesus, and flowered afresh, after the fall of Cnossus, as the Mycenaean culture. The trade of the Bronze Age Mycenaeans with peoples farther north and west was of vital importance in the development of Europe, and made itself felt indirectly as far afield as Scandinavia and the British Isles. Mycenae went down under fresh migrations from the north. During the subsequent upheavals, the use of iron spread to Greece, perhaps from Anatolia.

As things settled down, Greek political organization developed rapidly in the form of the city

state. The system was fostered by geographical conditions.

Maritime and commercial development followed naturally, as there was easy communication by sea with W. Asia and Egypt. Between 700-500 B.C. a high political organization was attained by many city states, together with a remarkable intellectual and artistic activity. The Greeks were so far in advance of the rest of the world that it has been said that "nothing moves in the world which is not Greek in origin." The statement is not strictly true. Moving forces, notably Christianity, have come out of the East; Celts, Romans, and Teutons have all made contributions; but the truth remains that the most active forces of progress developed with the Greeks.

The Italic peoples found their way through the passes in N. Italy, crossed the Lombard plain, and pushed S., breaking across the Apennines into the W. plains. There they fought with the earlier inhabitants, notably the Etruscans, themselves immigrants from Asia Minor. The Italians, like the Greeks, developed politically on the city state system. Greeks and Italians alike seem to have passed through a stage when each state had an hereditary monarch to a stage when the monarchy was absorbed by an aristocracy, displaced in its turn by a military despotism or tyranny.

The Rise of Rome

The primacy among the Latin states, whose league stretched S. from the Tiber, was won towards the end of the 6th century B.C. by the Romans, whose city, Rome, founded according to tradition in 753 B.C., was the barrier fortress between Etruscans and Latins.

The 5th and 4th centuries B.C. formed the most brilliant period in Greek history, in which first the Hellenes stemmed the westward pressure of the Asiatic powers, then carried their own political, literary, and artistic development to its highest point, and, led by Alexander the Great, shattered the great empire of Persia. The passion of each state for individual independence, and mutual jealousies among them, prevented the Greeks from building up a common national structure. Neither Athens nor Sparta succeeded in establishing her own supremacy over the rest of the states; Macedon at last won the leadership about 340 B.C., but failed to create a united empire.

Meanwhile Rome, after a severe struggle, broke up the Etruscan

power, which received its *coup de grâce* at the hands of Celtic invaders from the N., who penetrated as far as Rome (394 B.C.), but then rolled back beyond the Apennines to the plain of the Po.

The Romans blocked the Celtic invasion of Italy, and, freed from the severe Etruscan pressure on the N., gradually came to dominate the Latin states and the kindred tribes, Sabines, Aequi, Volsci, and Samnites, who were pushed down on the E. and S., after the Latin occupation of the lands W. of the Apennines. Rome, compelled by her position to maintain a political organization adapted to military needs, won in Italy undisputed ascendancy.

Meanwhile the death of Alexander the Great, in 323 B.C., left his empire to a century of disintegration. That same century, 300-200 B.C., saw the great struggle between Rome and the Semitic power of Carthage, which had established itself in N. Africa, to some degree in Sicily, and in Spain. Carthage was not decisively crushed until 202 B.C. Italy had supported Rome in the momentous conflict; the result of which was that not only was Rome's ascendancy overwhelmingly confirmed in Italy, but her sway was also established in the Spanish peninsula, with its mixed population of Celts and pre-Celtic Iberians.

During the next 170 years (200-30 B.C.) the dominion of the Roman republic expanded. The conquests of Julius and Augustus Caesar completed the subjection of all Europe W. of the Rhine and S. of the Danube, including the whole Celtic or partly Celtic area, except Britain, of which the part now called England was absorbed 100 years later. But all along the Rhine and the Upper Danube, the Teutons were now pressing upon the Roman frontier. The system which had built up the might of the Roman republic was not adapted to the administration of so heterogeneous an empire. Concentration of control was a necessity. Augustus gathered into his own hands the powers that enabled his genius to shape an imperial system under a single control.

For 400 years and more, the civilized world meant the Roman empire, which covered much of Europe and parts of Asia and Africa. On its borders there was incessant war; within it reigned the Roman Peace, save when the death of an emperor afforded a commander in some distant province the chance of snatching at the imperial purple.

W. of the Adriatic and the Rhine, the peoples of the continent became thoroughly Latinised in language and political ideas, though across the Channel Latinism was little more than a superficial veneer which touched not at all either Celtic Ireland or the Celtic north of the island of Britain. In the Balkan peninsula, Hellenism held its own against Latinism except in that part of the province of Dacia that became modern Rumania.

Towards the end of the 3rd century A.D. Teutonic hordes were surging against the Roman barrier, pressing now southward as well as westward upon the middle and lower Danube. At the close of the 3rd century the imperial system was reorganized by Diocletian, and a few years later by Constantine, who transferred the headquarters of the empire in 330 from Rome to Byzantium, which he renamed Constantinople. At the same time, after three centuries of repression and persecution, Christianity became the popular religion under the imperial sanction, and the ecclesiastical organization of the Church was officially recognized. Rome thus acquired the religious primacy of western Christendom when her political primacy was lost.

Barbarian Irruptions

With the beginning of the 5th century, when the empire was parted into E. and W. under the two sons of Theodosius, the flood-gates of the imperial frontiers burst, and the Teutons swept over the barrier. The Visigoths burst into Italy under Alaric, and moved W. into S. Gaul and Spain, whither they had been preceded by Vandals and Sueves. Behind the Goths came a more terrible conqueror, Attila and his Huns, not Teutons, but Tartar hordes who for two generations had been moving across S. Russia from Central Asia. The Goths in the W. had chosen to profess allegiance to the empire; they helped the imperial armies to turn back the Huns at Troyes, 451.

The dispersal of the Huns made way for fresh Teutonic irruptions. The Ostrogoths, after overrunning much of the Balkan peninsula, turned W. and established a new Gothic dominion in Italy under Theodoric, who called himself a lieutenant of the single emperor now reigning at Constantinople. Then at the beginning of the 6th century the Teutonic Franks swept over the Rhine and made themselves masters of the land which still bears their name, though the Franks themselves never completely Teutonised the country,

which remained persistently Latin. At the same time the native customs of the Franks in France, as of the Goths in Spain, fusing with the established Latin system, produced the social and political system known as feudalism. Other Teutonic tribes followed; Burgundians into the Rhône valley, and Lombards into the Lombard plain. The latter established their lordship over most of Italy, the Ostrogoths having been extirpated by the generals of Justinian, whose successors failed to retain the domination of the E. over the W. But nowhere did the Teutons effectually Teutonise populations already Latinised. Italy, France, and Spain remained essentially Latin, though Latinism hardly expanded E. of the Rhine or N. of the Danube.

With the rise of Mahomedanism in the 7th century, Europe was once more threatened with Orientalism. Early in the 8th century the Moors invaded Spain and drove the Christians into its N. corners. But when they flooded over the Pyrenees, their armies were shattered by Charles Martel at the battle of Tours or Poitiers, 732, and the tide was rolled back for ever behind the Pyrenees, though Saracen sea-rovers established a footing in Sicily. In the E. the Mahomedan onslaught had been hurled back 14 years before by the emperor Leo the Isaurian under the walls of Constantinople. Except in the S. of Italy all semblance of control by the emperor at Constantinople vanished from W. Europe.

The Empire of Charlemagne

Charlemagne now revived the W. Empire. He crossed the Pyrenees and drove the Moors S. of the Ebro. He completed his father's work of crushing the Lombards in Italy. His armies smote the heathen Saxons in the N. and the Bavarians in the S., and compelled them to adopt Christianity; still pushing E., they shattered the Mongolian kingdom of the Avars in Hungary. At the instance of the pope, Charles was crowned emperor in Rome on Christmas Day, 800. When he died in 814, the Elbe and the Adriatic were approximately the E. boundaries of the new Holy Roman Empire which he had created. The Danube still remained in effect the N. boundary of the Byzantine empire.

Under the grandsons of Charlemagne his empire parted into three domains, the W., which shaped itself into the kingdom of France, the E., which was German, and the intermediate, "middle," or Burgundian, which stretched from the North Sea to the Gulf of Lions, and

included most of Italy, the S. of which, however, still belonged to the E. Empire. The crown of the Holy Roman Empire generally went with the E. or German kingdom. Burgundy broke up, part going with France and part with Germany, but never with a definite bond, while Italy became a congeries of dukedoms and counties over which the emperor on the other side of the Alps could exercise little authority. When the house of Charlemagne died out in Germany, the crown of the German kingdom, of the Holy Roman Empire, passed by election to the dukes of Saxony. The first, Henry the Fowler, was never crowned emperor; but he and his son, Otto the Great, stemmed the onrush of the third Mongolian horde which occupied Hungary, the Magyars, who nevertheless retained permanent possession of that tract.

The Middle Ages

The close of the 10th century, then, is the era of transition from the chaos of the earlier Middle Ages to what is generally more distinctively meant by the medieval period. During the 9th and 10th centuries the sea-rovers from Scandinavia had planted their colonies of Danes or Northmen in the British Isles and in the N. of France, and had shaped their own kingdoms in Norway, Denmark, and Sweden. In the 5th and 6th centuries the Teutonic English had conquered more than half the island of Britain, and in the 10th century England had become a fairly consolidated state.

France was on the way to consolidation under the house of Capet, which had displaced that of Charlemagne, but as yet the king of France was little more than a premier baron amongst many, some of whom ruled wider domains than the king himself. Spain was still mostly under the Saracen sway, though the Christian princes were soon to emerge from their northern fastnesses to win it back, establishing the kingdoms of Castile and Leon, Portugal, Aragon, and Navarre.

In the Spanish kingdoms, as in France, the king was hardly more than a premier baron. Central Europe regarded the German king as its head, though scarcely as its ruler, while to W. Christendom, in his character of emperor, he represented the idea of Christendom as a unity. The popes, as spiritual heads of Christendom, now began gradually to claim an authority higher than that of any lay potentate. Outside the empire on the E. the Slavs were establishing the Polish and Bohemian king-

doms, and had already given half the Balkan peninsula and the whole Danube basin a Slavonic character, though they owned the supremacy of the emperor at Byzantium. The latter, with his hardly held dominion in Asia, barred the door into E. Europe against the Mahomedans.

The new age was the age of feudalism, which before the end of the 11th century had established itself everywhere. Theoretically, the king owned every inch of soil in his kingdom. He had granted great tracts or small to his servants on condition of military service. They in turn had granted portions upon like conditions, while every one had settled husbandmen upon the soil, allowing them patches on condition of agricultural and other services to the lord.

But outside England, the tenant generally owed his services to his immediate lord and was bound to fight for him against anyone else, even the king. Hence if one of the king's men or barons accumulated enough territory, he had at his back an army of tenants with which he could levy war against the king. The royal authority depended upon the loyalty to the king of a proportion of the baronage. Thus the French dynasty and each German dynasty tried to expand the crown estates at the expense of the great barons. In France the counts of Anjou acquired by marriage the dukedoms of Normandy and Aquitaine as well as the independent kingdom of England. Essentially the Hundred Years' War between England and France in the 14th and 15th centuries was a struggle between the crown and the duke of Aquitaine, who happened also to be king of England. The final victory of the French crown, and its absorption of the duke's dominions, cleared the way for the final establishment of an absolute monarchy in France.

Pope and Emperor

In Germany, on the other hand, the monarchy was elective; each time that the succession changed, the new dynasty had to start afresh the absorption of feudatory territory, and consequently the German kings failed to establish absolute monarchy. Germany remained an aggregation of estates great and small, over which the emperor exercised little control.

The papacy again established its own supreme authority over the whole ecclesiastical organization of W. Christendom, and sought to assert that authority over all lay potentates. Within the empire, in Germany and in Italy, the struggle between the pope as the spiritual head of Christendom, and the

emperor as its temporal head, helped the baronage to maintain their independence, since they could support emperor or pope as best suited themselves.

Europe, then, in the second as in the first half of the Middle Ages, shows nothing like a system of organized states. Through the Scots' War of Independence and the Hundred Years' War between England and France, the defined kingdoms of England, Scotland, and France were consolidating themselves during the four centuries which followed the Norman conquest of England in 1066. Spain grew into a group of four separate kingdoms, the Moorish kingdom of Granada in the S., and the kingdoms of Portugal, Castile, and Aragon, to the last of which Sicily was attached in 1282. Central Europe—Germany—was only a loose confederation of states in a state of perpetual flux.

Italy became practically a collection of city states, in which there was developed an intellectual life far in advance of that of the rest of the world, especially during the 14th and 15th centuries. On the N. of the empire lay the Scandinavian kingdoms; to the E. of it Poland, Bohemia, which had a connexion with the empire, and Hungary. S. of Hungary chaos for the most part reigned on the Balkan peninsula, though Byzantium held back the Asiatic invaders till its fall

in 1453, when a Turkish dominion was established in the European continent E. of Poland. The development of a Russian empire was prevented by the great Tartar incursion in the 14th century; but by the end of the 15th the Muscovite kingdom was shaping itself.

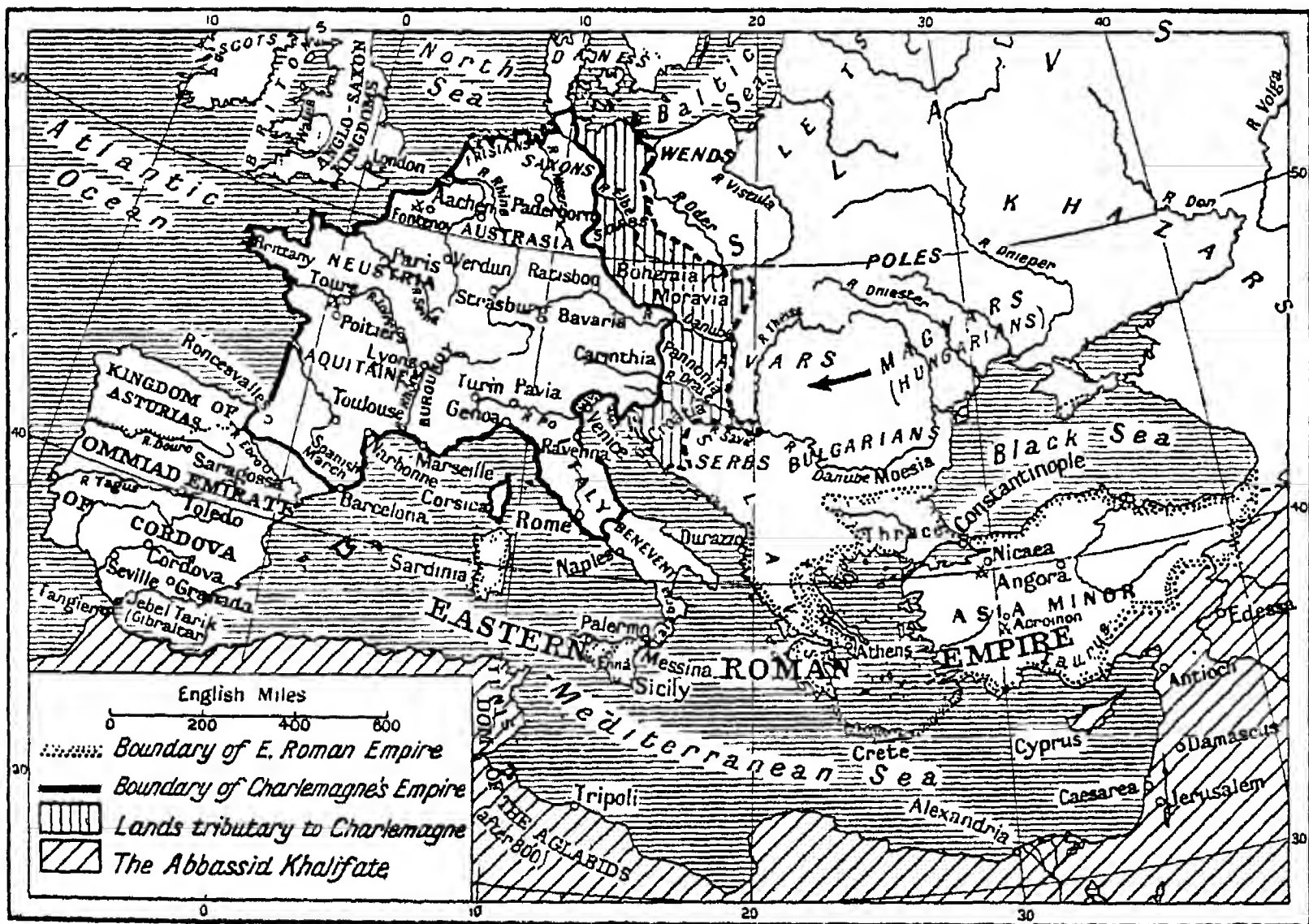
The latter half of the 15th century marks the transition from medieval to modern Europe. The union of the crowns of Castile and Aragon by the marriage of Ferdinand and Isabella, 1469, unified the Spanish monarchy. The imperial crown had passed to the Hapsburg, Frederick III of Austria, in whose dynasty it became hereditary. The use of gunpowder was to revolutionise warfare. The voyages of Christopher Columbus and Vasco da Gama opened the ocean pathway to a new world in the W. and to the

GROUP	LANGUAGE	PERCENTAGE
LATIN 26%	FRENCH	8.4
	ITALIAN	8.4
	SPANISH	3.2
	RUMANIAN	2.8
	PORTUGUESE-GALICIAN OTHERS	1.7 1.5
TEUTONIC 32%	GERMAN	17.5
	ENGLISH	10.0
	DUTCH-FLEMISH	2.5
	OTHERS	2.0
SLAVONIC 32.6%	GREAT RUSSIAN	13.8
	UKRAINIAN	7.6
	POLISH	4.4
	SERBO-CROAT	2.1
	CZECH	1.6
	WHITE RUSSIAN OTHERS	1.5 1.6
OTHERS 9.4%	HUNGARIAN	2.0
	GREEK	1.0
	OTHERS	6.4

Europe. Table showing the division of the peoples of modern Europe into racial and linguistic groups, with the percentage, in each group, of the total population of about 590 millions

E., hitherto cut off from Europe by the Muslim wall which the crusaders had failed to break through. The intellectual revival in Italy received a new impulse from the revived study of ancient literatures following upon the fall of Constantinople and the dispersion of Greek scholars in the W. Men were beginning to challenge the doctrines of the Church itself.

With the 16th century the history of Europe becomes international, as never before. The struggle of individual states for general European ascendancy now begins, and against this effort the common interest in the preservation of a balance of power makes itself felt. Across this for 150 years cuts the religious struggle between Protestantism and Romanism, and this again is crossed by the struggle for dominion over colonial lands.



Europe. In the 8th and 9th centuries the supreme historical event was the substitution of the Holy Roman for the Eastern Roman Empire as the predominant power; as established by Charlemagne it comprised Gallo-Latin Neustria, Teutonic Austrasia, and Lombard Italy. In Spain the Ommyad emirate was set up by Abd-ur-Rahman. In the Near East, Bulgarian and Serbian kingdoms were coming into existence. Islam controlled Africa and western Asia, except Asia Minor

The accident of marriages conveyed to one man, Charles V, the entire Spanish inheritance, including Sicily, S Italy or Naples, the Netherlands, and the whole Hapsburg territorial inheritance in Germany, while he also succeeded his grandfather as emperor in 1519. A year later the floodgates of the Reformation were opened by Luther's defiance of the papacy. The German inheritance of the Hapsburgs was transferred to Charles's brother Ferdinand, who acquired for his own house the crowns of Hungary and Bohemia, and the Hapsburg monarchies became the barrier between Europe and the Turks. During Charles's reign Protestantism was established in Scandinavia, over the N half of Germany, and in the N half of the Netherlands; while it was planted as yet insecurely in England, Scotland, and France.

Religion and Politics

When Charles died in 1558 his son Philip II was ruling over the Spanish dominions and the Netherlands, Ferdinand was emperor, and a truce had been confirmed between the Protestant and Catholic states of the empire. By the end of the century Philip had virtually lost the N. Netherlands, which became the United Provinces of the Dutch Republic, while the Catholic S. still remained the Spanish Netherlands. England and Scotland had both become definitely Protestant, soon to be united under one crown; while France remained Catholic, with freedom of worship secured to the Protestants, and her foreign policy directed by purely political considerations irrespective of religion. Maritime ascendancy, once enjoyed by Italian city states had first passed from them to Portugal and Spain, but was now decisively transferred to England and the Dutch states.

The struggle of the religions was fought out in the Thirty Years' War (1618-48), the emperor himself championing the Catholics, while Gustavus Adolphus of Sweden intervened on behalf of Protestantism. Its outcome left the division between Catholic and Protestant states in Germany very much where it had been at the beginning. It also broke the last attempt to establish an effective central control of the empire in the hands of the emperor. And meanwhile Spain had become practically a secondary power, while France, by Richelieu's policy, had developed a strong central government.

In the next phase, Louis XIV of France, a monarch whose abso-

lutism in his own country was almost unqualified, sought through a long series of wars, 1667-1713, to enlarge the borders of France and to make her the dictator of Europe. For 40 years the main resistance came from Spain and Austria, and from the little Dutch state under William of Orange, whose accession to the thrones of England and Scotland brought Great Britain into the European struggle, of which the last phase at this stage was the War of the Spanish Succession (1702-13). That war gave Spain herself to a Bourbon, Philip, a grandson of Louis, who was himself succeeded on the throne of France by his great grandson Louis XV. It also transferred the Spanish Netherlands to Austria, together with the Two Sicilies.

Meanwhile within Germany the electorate of Brandenburg had been erected into the kingdom of Prussia (1701); and outside, England and Scotland had been incorporated in the kingdom of Great Britain (1707), while in the E. Russia had at last been organized into a consolidated dominion by Peter the Great, and Sweden, under Charles XII, had made her last effort to retain among the European powers the position won for her by Gustavus Adolphus. Britain had now emerged as the supreme maritime power, and established naval bases at Gibraltar and Minorca. The reign of Louis XV in France (1713-74) covers an era of protracted European struggles. The last aggressive effort of Turkey was crushed in 1718; Russia established herself on the Baltic and the Black Sea, and extended her boundaries eastwards.

Prussia and Silesia

The War of the Polish Succession (1733-38) set up a Bourbon dynasty in the Sicilies. The War of the Austrian Succession (1740-48) saved the Austrian dominion from disintegration, except for the annexation of Silesia by Frederick II of Prussia—a robbery which led the way to a regrouping of the powers in the Seven Years' War (1756-63). Great Britain, the former ally of Austria, now supported Prussia, which had to defend itself against the French on the W., the Austrians on the S., and the Russians on the E. Great Britain's part in the war was mainly on the seas and beyond them, where she fought the French in America and in India, and in effect turned them out of both. In Europe, the war confirmed Prussia as a first-class power, still in possession of Silesia; but no fighting was needed when, in 1772, the tsarina

Catherine arranged with Frederick of Prussia and with Austria the first partition of Poland, a partition carried farther in 1793 and 1795, when the whole of Poland was absorbed by one or other of the three.

The development of the last 300 years had established despotic governments in every state in the European continent, large or small, with the exception of Switzerland and Holland. The despots were generally well disposed towards their subjects. Many tried to improve the conditions of their people, and some succeeded. But, broadly speaking, most of the populations lived actually or approximately in serfdom. Political liberty was nonexistent, and between the classes there was an almost impenetrable social barrier, while the burdens of taxation and service pressed most heavily upon those least capable of supporting them.

The French Revolution

The summoning of a popular assembly in France—the states-general of 1789—in the hope of discovering a panacea for the imminent financial ruin of the country, proved to be the first step in a wide revolution. Successive assemblies passed from advocating the abolition of privileges to demanding the abolition of the privileged. The extremists captured the control of the government, first emasculated and then wiped out the monarchy, and went on to proclaim themselves the liberators of Europe from the tyranny of monarchs and aristocrats.

Great Britain, whose constitutionalism had been the model of the reformers before they were swept away by the revolutionary tide, was swung into the vortex when the new republic tore up treaties, and set about annexing the Austrian Netherlands in 1793. Long before the terrors of the revolution within France had exhausted themselves, the armies of the republic, reckless of established methods, were facing and routing the orthodox armies of the monarchies. Prussia and Spain soon retired from the struggle; Bonaparte's Italian campaigns broke Austria. Bonaparte betook himself to Egypt; Britain, fighting on alone, won the mastery of the Mediterranean; Austria returned to the attack, supported by Russia. The return of Bonaparte and his establishment as First Consul of France was followed by the shattering of the new coalition, and even by the accession of Great Britain to the peace of Amiens, 1802.

In 1803 the Franco-British duel was renewed; two years later a new coalition was formed. Nelson

sealed the naval supremacy of Great Britain at Trafalgar, 1805, but Napoleon, now emperor of the French, shattered the new coalition at Austerlitz. Prussia, aroused at last, took up the challenge and was crushed at Jena, 1806, and Napoleon made his peace with Russia at Tilsit in 1807, and set about the reconstruction of Europe according to his own fancy. His attempt to appropriate the Spanish peninsula brought Great Britain into the war for the first time as a military power, 1808. For five years Napoleon's generals strove in vain to drive the British into the sea. But Napoleon quarrelled with the tsar, and his Moscow expedition in 1812 ended in irretrievable disaster. The uprising of the peoples rather than of the governments overwhelmed him, he was compelled to abdicate in 1814, and though he reappeared to make a last bid for victory, he was finally crushed at Waterloo, 1815.

The congress of Vienna restored the map of Europe so that the state boundaries were much as they had been in 1792, except that the Netherlands were formed into a new kingdom. The old dynasties were replaced and the old despotisms renewed, the former states of the empire forming the German Confederation. But the French Revolution had kindled new ideas of liberty, partly democratic, partly nationalist, and despite the efforts of Metternich, those movements could not be crushed. Greece broke free from her subjection to Turkey; France turned out the Bourbons and established the constitutional Orleans monarchy in 1830. The S. Netherlands separated from Holland in 1839 and became the Belgian kingdom. Liberals and reactionaries did battle in Spain and Portugal.

Austria and the German Confederation

Then in 1848 came the Year of Revolutions. In almost every country, nationalist, constitutional, or democratic movements came to a head. Generally, though not always, the Reaction was for the time victorious. France made herself into a republic, but in five years the nephew of Napoleon had turned the republic into the Second Empire. Limited constitutions were conceded in sundry German states. Austria kept her grip on the diverse portions of her empire, and though the title of the Holy Roman Empire had been dropped since 1806, she still retained her place as leader, or as joint leader with Prussia, of the German confederation. The mutual jealousies and distrust between Great Britain and Russia, the causes of which

were more Asiatic than European, were a constant disturbing factor in European affairs.

The three great movements afoot were towards the liberation of the Balkan peninsula from Turkish rule, towards the unification of Italy, and towards the unification of Germany under the headship of Prussia. The rising of N. Italy under the leadership of Victor Emmanuel, king of Sardinia, supported by Napoleon III, in 1859, liberated most of N. Italy from Austria and from the temporal control of the papacy and created the kingdom of N. Italy. The revolt of Sicily and Naples against the Bourbon dynasty in 1860 was followed by the adhesion of S. Italy to the N. kingdom, and in 1861 the united kingdom of Italy was established, though Austria still held the N.E. corner and Rome still belonged to the pope. In 1871, however, it was united to the new kingdom of which it was made the capital.

Policy of Bismarck

Bismarck organized the Prussian military power, contrived the annexation of Slesvig and Holstein from Denmark, and procured the Seven Weeks' War with Austria in 1866, which in effect ejected Austria from the German confederation and gave Prussia decisive ascendancy therein. Incidentally, Italy was rewarded for her assistance to Bismarck by the acquisition of Venetia. Bismarck's policy achieved its triumph with the Franco-Prussian War of 1870-71. The recovery of the Rhine provinces from France was accompanied by the recognition of the king of Prussia as German emperor and by the consolidation of the new German Empire under Prussian direction, with a machinery which, for the first time in Germany's history, brought her under a single control and made her the first military power in Europe. Another outcome of the war was the establishment of the third republic in France.

Turkish misrule was the excuse or justification of the wars with Turkey upon which Russia entered in 1853 and 1877. In both, British intervention was responsible for the preservation of Turkey, but those wars brought about the virtual independence, first of Rumania and then of the Slav states of Bulgaria, Serbia, and Montenegro, while Bosnia and Herzegovina were placed under Austrian administration, paving the way for annexation after an interval of 30 years. The outstanding features, however, of the European situation in the latter years of the 19th

century were the alliance of the three emperors, and the substitution for it of the alliance of the three powers, Germany, Austria-Hungary, and Italy, which was answered by the alliance between France and Russia. The settlement of outstanding differences between Great Britain and France in 1905 prepared the way for the Triple Entente between Great Britain, France, and Russia, which became an accomplished fact in 1907, while its solidarity was proved to the great dissatisfaction of Germany in 1911 by the British support of the French in connexion with the Agadir incident. The Balkan Wars of 1912-13 liberated the Balkan States from the last relics of Turkish sovereignty, but failed to establish a concord among them, whereof the fruits were later to become apparent.

Two more events prior to 1914 have here to be noted. In the 15th century Denmark, Norway, and Sweden had been united under one crown; in the 16th Sweden had separated herself, but Norway had remained attached to Denmark. At the European reconstruction in 1815 Norway had been taken from Denmark and attached to Sweden. The union, however, had never been harmonious or satisfactory to Norway, and in 1905 she procured her establishment as a separate kingdom. In 1908 a revolution in Portugal expelled the dynasty and inaugurated a republic.

The Climax of Power Politics

The causes, campaigns, and conclusion of the most devastating war in history up to that time—it lasted from July 28, 1914, to Nov. 11, 1918—are described under First Great War. The chief protagonists at the start were the central powers, Austria-Hungary and Germany, against Russia and France. Great Britain immediately joined the latter group, among which were Serbia and Belgium as victims of attack; Turkey threw in her lot with the central powers, as later did Bulgaria; in 1915 Italy broke with her allies and joined the Entente Powers; by 1917 the German submarine campaign had brought the U.S.A. into the war. That year Russia collapsed in two internal revolutions; and another year was needed to defeat the central powers, the first break coming in Bulgaria and Turkey. Peace making occupied most of 1919-20 (see St. Germain-Laye, Treaty of, and Versailles, Treaty of). Czecho-Slovakia and Yugoslavia appeared as new states; Poland was resurrected; Finland, Estonia, Latvia, and

Lithuania gained independence through the disintegration of the old Russian Empire.

A. D. Innes

The treaty of Versailles, signed in the hall of mirrors on June 28, 1919, was followed at brief intervals by treaties with Austria, Hungary, Bulgaria, and Turkey which registered the overwhelming victory of the Allies over the central powers and their satellites in the First Great War. Like all dictated settlements, they were bitterly resented by the defeated parties. The new frontiers and the limitations imposed on the sovereignty of the five states could be maintained only so long as the unity of the victors was preserved. This condition, however, was not fulfilled. The senate of the United States, reverting to its traditional isolationism, declined to approve the treaty of Versailles (which included the covenant of the League of Nations) without reservations which President Woodrow Wilson felt unable to accept.

This damaging blow at the new order was followed by a rift in the *entente cordiale* (q.v.). After vetoing the French claim to sever the whole of German territory W. of the Rhine from the new Reich, Great Britain and the United States offered France a promise of military support in the event of renewed German aggression. The guarantee enshrined in the tripartite treaty of June 28, 1919, however, was joint, not separate, and when the American senate repudiated the signature of the president, the obligation on Great Britain lapsed. Possessing neither the coveted territory nor the Anglo-American guarantee, France felt a legitimate grievance.

French Occupation of the Ruhr

Negotiations in 1921-22 for a British guarantee, initiated by Briand, broke down primarily because the Lloyd George government refused a long-term commitment. Henceforth France felt that she must look after herself. She concluded an alliance with Poland, and Poincaré's decision to occupy the Ruhr in Jan. 1923, on the ground that German reparations were in arrears, destroyed what little vitality was left in the *entente cordiale*. Convinced that France's step was legally unjustifiable, the British and American governments withdrew their troops from the Rhineland. The economic results of the occupation of the Ruhr strengthened Anglo-American disapproval, for the mark lost all value and the industrial

recovery of Germany was blocked. Great Britain and France agreed that Germany should remain permanently disarmed; but while the former desired her economic rehabilitation in the interest of European prosperity, France believed that to render her harmless it was necessary to keep her poor. When Stresemann called off the passive resistance of the Ruhr in the autumn of 1923, and a commission under C. G. Dawes (q.v.) was appointed to examine afresh the reparations problem, Poincaré congratulated himself on the success of his policy. Yet his position was not so strong as he believed. Italy, ruled by Mussolini since 1922, was with him, but her share in the Ruhr adventure was small. In May, 1924 the French chamber elected in 1920 came automatically to an end, a majority of the left was returned, and new pilots set out on a fresh course.

Treaty of Locarno

For the next six years, the dark clouds which had overhung Europe seemed to be melting away. A temporary limitation of naval armaments had been arranged at the Washington conference in 1922. The new French government, with Herriot at the head, believed with Briand that Frenchmen "must learn to speak European." The French troops were withdrawn from the Ruhr, a new and stable currency was introduced in Germany, and the economic recovery of Europe proceeded apace. In 1925 Stresemann, the German foreign minister, informed Paris and London that he was willing to recognize the *status quo* on Germany's W. frontiers, in other words, to surrender all claim to Alsace and Lorraine. After months of negotiation the territorial stabilisation of the west was registered in the treaty of Locarno, the joint work of Stresemann, Briand, and Austen Chamberlain, with the assistance of Lord D'Abernon, British ambassador in Berlin. Great Britain and Italy pledged themselves to resist attack on the Franco-German and Belgo-German frontier, whether it came from Germany or France. A similar renunciation of claims to revise the new German-Polish frontier, strongly urged by France and Poland, was refused by Stresemann, though he promised not to attempt a change by arms. British opinion approved both the undertaking to fight for the *status quo* in the west and the refusal of a similar

obligation in the east. A year later, in Sept., 1926, Germany joined the League of Nations with a permanent seat on the council. Of the five great powers of Europe, only Russia was absent, and the prestige of the League increased from year to year. When the assembly met every year in Sept., all eyes were turned to Geneva, where Lord Cecil, Nansen, and other "good Europeans" laboured zealously for an organized world.

Kellogg Pact of 1928

The next milestone on the road to peace was the signature of the pact of Paris, popularly known as the Kellogg pact, on Aug. 27, 1928. In 1927, on the tenth anniversary of the entry of the United States into war, Briand proposed to the American people a mutual engagement to outlaw war for a hundred years. Since a conflict between such old friends was unlikely, the American secretary of state proposed that all states should pledge themselves to renounce war, not merely for a century but for ever. The American project was accepted without enthusiasm by the French, who resented the absence of military sanctions. Their apprehensions were diminished by Kellogg's formal declaration that the signatories were not debarred from the right to defend themselves against unprovoked attack, and that violation of the pact would automatically release the other parties from all obligations to the treaty-breaking state. Since belligerents almost always assert that they are fighting in self-defence, the reservation reduced the renunciation of war to an empty phrase. Moreover, the British government reserved liberty of action in "certain regions the welfare and integrity of which constitute a special and vital interest for our peace and safety." The reference to Egypt was clear enough. If ever an international agreement deserved the name of a scrap of paper, it was the pact of Paris, signed though it was by most states in the world.

In the same year, 1928, the League assembly approved a general act for the peaceful settlement of international disputes, providing for conciliation in cases unsuited to the Hague Court. Though Great Britain acceded to the general act only in 1931, the MacDonald government decided in 1929 to sign the optional clause of the statute creating the permanent court of international

justice at the Hague. A few countries including France had already signed this, but had not ratified their signatures. Though important cases had been referred to the court with satisfactory results, only states which voluntarily accepted its verdicts in advance were under any compulsion to make use of it. Other states, large and small, now came trooping in. The British government, however, made an important reservation by excluding domestic and inter-Imperial questions. A further effort to organize peace—Briand's scheme for a European federation outlined at the League assembly in 1930—met with little approval and was dropped.

Two more indications of the general desire to reintegrate Germany into the life of Europe occurred during these years of hope. The Dawes plan for the payment of German reparations was superseded in 1929 by the Young plan, reducing the burden and creating the bank of International Settlements (*q.v.*) at Basel; and the last armies of occupation evacuated the Rhineland in the summer of 1930, five years before the date fixed at Versailles. The most unsatisfactory feature in the European landscape was the exclusion of Russia from the European family.

A third chapter opens with the Reichstag elections in September, 1930, when the Nazi deputies jumped from 12 (elected in 1928) to 107 (out of 475). The main cause was the impact of the American economic blizzard of 1929 which raised the figures of German unemployment to seven millions. Stormy weather was obviously ahead, and two of the most experienced pilots had been removed in 1929, Stresemann by death, Austen Chamberlain by a change of government. Only Briand remained, the ghost of his former self. Brüning possessed no stable majority. Everything combined to favour treaty-breaking and aggression.

Blows at the League

The first blow was struck in 1931 when Japanese troops seized Manchuria from the powerless hands of the Nanking government. The League of Nations expelled the offender, but no state cared to risk war by imposing economic sanctions. A second blow was the fiasco of the disarmament conference which met at Geneva in 1932. A third fell when Hitler as the leader of the largest party in the Reichstag became chancellor

on Jan. 30, 1933, resigned from the League, and solved the problem of unemployment by wholesale rearmament. In March, 1935 he announced the return to conscription, and Goering revealed that Germany possessed a formidable air force. More galling fetters were struck off in March, 1936, when German troops marched into the demilitarised zone of the Rhineland. Though this *coup* violated not only the dictated treaty of Versailles but also the freely negotiated Locarno pact, no action was taken by Great Britain or France, where the dread of another war outweighed the promptings of self-preservation. Here was the turning point in post-war history, since a stout wall in the west would enable Hitler to strike out in central and eastern Europe. Though Baldwin declared that her frontier was now on the Rhine, Great Britain had returned to her old system of a small voluntary army, and France lacked vigorous leadership. Foch, Clemenceau, and Poincaré were gone; weak coalitions rose and fell; the generals trusted to the Maginot line; and the output of munitions and armaments was small.

Mussolini Invades Abyssinia

The Versailles system, resting first on the political cooperation of Great Britain, France, and Italy, and secondly on the military predominance of France on the Continent, ended in 1935, when Hitler broke Germany's military chains and Mussolini invaded Abyssinia. Though Italy had been on the winning side in the First World War, she was disappointed with her share of the spoils, and thirst for colonial territory proved stronger than loyalty to her late allies. The crime was frowned on by the League but no effective action was taken. Before dispatching troops, munitions and poison gas through the Suez Canal, Mussolini (in an interview with Laval) assured himself that France would not make any difficulties; and the Baldwin-MacDonald cabinet, fearful of driving him into the German camp and disinclined to risk the Mediterranean fleet in vindicating the authority of the League, played for safety. The policy of limited economic sanctions, while failing to prevent the conquest of an unarmed and primitive community, angered the Italian people and made them look round for new friends. The dictators now grasped each other's hands. Visits were

exchanged, the Axis came into being, and effective Italian and German aid was rendered to Franco's rebellion in Spain. The adherence of Japan created what Hitler called the world-triangle. Three of the seven Great Powers were now banded together for aggression, which the other four were too disunited to check. The United States had left the stage. Russia, though she had joined the League in 1934, was sundered from the western powers by old suspicions and ideological differences. France, racked by party strife, was unready for another major struggle. Britain was weakened by sharp antagonism between the supporters of Neville Chamberlain's policy of appeasement and the partisans of rapid rearmament led by Churchill, who foretold war with Germany.

The Axis in Action

In March, 1938, Hitler seized Austria without opposition. The autocratic Schuschnigg regime, undermined by the Austrian Nazis and detested by the Socialists whose power had been broken by Dollfuss, collapsed like a house of cards, and Mussolini forgot his old pledge to stand by Austria to the end. Czechoslovakia, now vulnerable from the south as well as from the north and west, was the next victim on the list. Using the grievances of the Sudeten Germans as a pretext, Hitler secured the consent of Daladier and Neville Chamberlain at Munich in Sept., 1938, to the partial occupation of the country, though France was an ally and Great Britain had encouraged hopes of support if Germany attacked. Russia, though also an ally, was not invited to the Munich conference. Less than six months later, in March, 1939, President Hacha, the successor of Benes, who resigned after Munich, was summoned to Berlin and compelled by the threat of the immediate bombing of Prague to surrender the rest of his country.

Hitler Turns on Poland

Hitler now turned to the third item on his agenda of aggression. The denunciation of his ten years' pact of non-aggression with Poland concluded in 1934, followed by the customary vilification of the prospective victim, revealed where the next blow would fall. Hoping to avert it, Great Britain promised support in the event of an unprovoked German attack; and with France made proposals to Russia for the organization of mutual defence against aggression. But

Russian suspicions of the western powers were deep-seated, and the negotiations came to an abrupt end with the announcement on Aug. 24, 1939, that Germany and Russia had the previous day signed a ten-years' mutual non-aggression pact. On Sept. 1, 1939, German troops crossed the 1,200-mile long Polish frontier from north, west, and south. On Sept. 3 Great Britain and France declared war on Germany, and the Second Great War had begun.

G. P. Gooch

[The course of the Second Great War in Europe is fully described under the headings Second Great War; Russo-German Campaigns, 1941-45; Europe, 1944-45, The Liberation of Western; Dunkirk Evacuation, 1940; the battle of Arnhem; and numerous shorter entries.]

The end of the Second Great War left Europe devastated as never before. Large parts, sometimes the whole, of many towns right across the Continent lay in ruins; hundreds of bridges were down; railways and port installations were extensively damaged; and several million civilians, forcibly removed from their homes by the German invaders, had to be repatriated or otherwise provided for (*see* Displaced Person), as had also many thousands of prisoners of war.

All the liberated countries set to work with a will to rebuild what had been destroyed. Through U.N.R.R.A. (*q.v.*) better-off members of the United Nations provided aid for the less fortunate; and through the European Recovery Programme (*q.v.*) the community of Europe, with generous American assistance, succeeded in reconstructing its shattered life.

Division into East and West

The most striking political development in the years following the Second Great War was the increasingly rigid division of Europe into two hostile regions, separated by an "iron curtain" of censorship, suspicion, and "cold war"—a western part composed of France, the Low Countries, Scandinavia, Italy, and the U.K., and an eastern part composed of Russia and countries within the Russian orbit—Poland, Rumania, Hungary, Bulgaria, and Czecho-Slovakia. Germany, divided into British, U.S., French, and Russian zones of occupation, was soon split into a "western" and a Russian zone, a division emphasised in 1949 by the creation in the west of the

federal republic of (W.) Germany and in the east of the E. German "democratic republic" with a Communist government on the Russian model. Yugoslavia, at first a member of the Russian-dominated group, but expelled from the Cominform (*q.v.*) in 1948, succeeded in maintaining its independence of both groups. Greece, after five years of civil war, retained its contact with the west; and Turkey entered into relationship with western Europe. Spain, at first isolated from both groups, was accepted into the western when in 1952 it permitted the establishment of U.S. military bases on Spanish soil.

In one country after another of the eastern group a minority Communist party seized power, instituting an authoritarian state; in the west fear of the vast power of Russia, no longer an ally but, it seemed, a potential enemy, promoted a growing tendency towards economic and, to some extent, political integration, a tendency expressed in the formation of a number of international bodies (*see under* European Unification). A criterion of the "westness" or "eastness" of any European nation rapidly came to be its acceptance or refusal of American financial aid as extended in the Marshall plan and the European Recovery Programme, and its willingness to join the North Atlantic Treaty Organization (*q.v.*).

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EUROPE, 1944-45, THE LIBERATION OF WESTERN. Having decided, as they did at an early stage of the Second Great War, that Germany could not be defeated without a landing on the north coast of France, the Allied combined chiefs of staff found themselves faced by the stiffest problem they had to overcome: that of establishing a secure foothold upon a fortified continent. Later stages of the attack would be difficult, but this was the most difficult of all.

In Feb., 1944, the enemy had 53 divisions in the west under the supreme command of F.M. von

Rundstedt; by June 3 his forces in France and the Low Countries had been increased to 60 divisions—10 panzer and 50 infantry. Half that strength, if it could concentrate quickly, would have been more than enough to drive any landing force back into the sea. The secure foothold had to be established before that could happen. This called for very careful study of the speed with which the enemy could concentrate and of the means of delaying him, such as attacks on his communications and decoy landings.

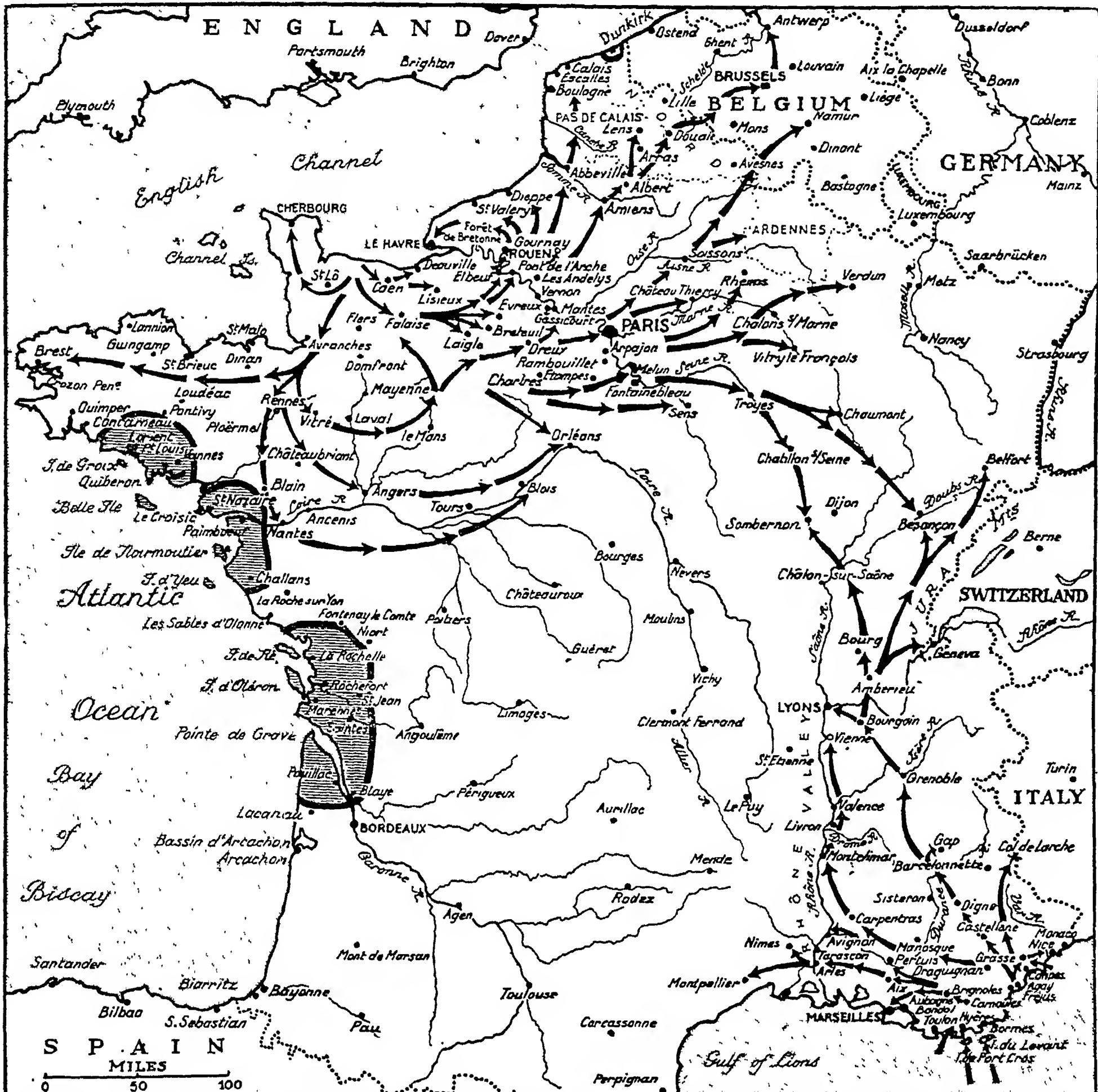
Allied preparations affected the whole life of Great Britain. Reserve stores for civilian consumption were accumulated in advance because the bulk of the available shipping would be temporarily taken over for the transport of the invading armies. The quartering, training, and movement of the vast forces involved was in itself a gigantic task. A simultaneous landing in the south of France, and combined operations to secure Rangoon and liberate Burma in the only way it could have been done quickly, were ruthlessly set aside because there was a shortage of landing-craft. Operation "Overlord," as the landing in N. France was called, took priority because everything depended on its success.

Special Equipment

A large amount of special equipment had been prepared to expedite the build-up and the breakthrough after the first landing. The outstanding examples were the material for the two artificial "Mulberry harbours" and for the petrol pipe-line laid under the sea (*see* Pluto, Operation). It also included special weapons called petards for the destruction of concrete, flame-throwing tanks, mine-sweeping tanks, amphibious tanks, and troop-carriers. Three airborne divisions were to be dropped, two at the base of the Cotentin peninsula to isolate Cherbourg, and the third to seize the crossings of the Caen canal to the E. of Seine Bay.

Seine Bay was chosen for the landings because it afforded shelter and at the same time was less heavily defended than other areas with good beaches farther to the east, while it fulfilled the needs of the strategists and tacticians of the Allied air forces.

The assault was preceded by a heavy air offensive against many targets, chiefly petroleum plants and communications, including



Liberation of W. Europe. This map indicates the general lines of advance of the Allied armies after the landings in Normandy, June 6, 1944, and on the S. coast of France, Aug. 15, up to the date of junction of the two forces near Sombernon, Sept. 11. Shaded areas remained in enemy hands, the La Rochelle enclave until late April, 1945, the others until after the German surrender in May

rolling stock. A system of shuttle-bombing between the U.K. and the Mediterranean and later between Italy and Russia was developed. By the day of invasion, 74 bridges and tunnels leading to the battle area were impassable; and Germany's oil production had been reduced to about 30 p.c. of its normal capacity.

The invasion began on June 6, 1944. The airborne forces were dropped first. Then the great fleet of landing craft discharged their loads of troops and material on the beaches of Normandy. Air opposition was virtually nil, thanks largely to the Germans' lack of petrol. The original landing parties consisted of five divisions—two British, one Canadian, and

two American—apart from the airborne divisions and some special troops. The operations were conducted by the British commander, Gen. Sir B. L. Montgomery, to whom this responsibility had been delegated by the supreme allied commander, Gen. Dwight D. Eisenhower. There was some stiff fighting, but the measures taken to overcome the beach defences proved effective.

By June 12, all the lodgements had been linked together. A heavy storm caused delay and serious anxiety, but the supply of material and food put ashore was adequate, and Montgomery's plan quickly began to develop. It was, in brief, for the American forces to secure Cherbourg and make a great right-

wheel till they were facing eastward in the direction of Paris. Half-way through this wheel they were to detach a powerful force to overrun Brittany. Meanwhile the British forces were to attract to themselves the maximum possible German strength in armour and grind it down in unceasing battles.

Cherbourg fell to the U.S. 1st army on June 27. The Germans had not concentrated speedily enough to endanger the rapidly growing landing force, but they had brought no less than six armoured divisions against the British, which was just what Montgomery desired. But the greater hitting-power and lesser vulnerability of the German tanks caused

the British heavy loss at this stage, when the suitability of the country for defence was also to the enemy's advantage. The employment of heavy bombers in direct support on an enormous scale failed to break through the German anti-tank defences. Neither the attempt on Hitler's life on July 20 nor the drastic purge which followed it appeared to affect the fighting in France.

The Allied strength grew with remarkable speed during the battles close to the beaches. Towards the end of July there were established in France 18 U.S. divisions, five of them armoured, and in the British-Canadian army group 15 divisions, five of these, including a Polish division, also armoured. What was equally important was that, in addition to nourishing the heavy battles in progress, the administrative services of the Allies had built up great reserves of essentials—food, petrol, ammunition, bridging material—to support a long advance when the time came.

The American break-out started on July 25. It was brilliantly successful, and Avranches, the gateway to Brittany, was reached six days later. The U.S. 3rd army, which came into existence on Aug. 1 and was commanded by Gen. Patton, thrust west into Brittany, south to cut the neck of the Brittany peninsula, and then, leaving one corps only to reduce the Brittany ports, wheeled eastward. The Germans attempted to swing back their front, but the hinges were knocked away by the British, working from west to east as the American wheel gathered increasing speed.

Counter-Offensive Towards Avranches

In Brittany German opposition was negligible, except in the ports, and American armour pushed forward quickly towards Brest. The wheeling wing reached Laval, Mayenne, and Domfront. On Aug. 7 the Canadian 1st army resumed its attack towards the towns of Falaise and Argentan. On the same day the enemy launched his first full-scale counter-offensive, when four armoured divisions and elements of a fifth, with infantry support, struck westward against the Americans with the object of reaching the sea and cutting off all the American forces south of Avranches.

It was a bold stroke and it gained some initial success, but the Americans, well supported by the tactical air forces, then stood

firm. Montgomery had hoped to catch the enemy W. of the Seine; he now saw the chance of doing so, by a British-American junction between Argentan and Falaise. He ordered part of the American force to swing northwards. There was a tremendous fight before, on Aug. 19, the escape route from the pocket thus formed was closed, during which some proportion of the Germans farther west made their way out. But their losses from bombing and artillery fire were enormous.

While that battle went on, other U.S. divisions pressed towards the Seine. On Aug. 20 the head of the U.S. 3rd army reached the river and made a crossing near Mantes. British, Canadian, and U.S. forces overran the "Falaise pocket" and destroyed or captured all the troops remaining in it, and then raced westward to the Seine.

German Losses in Men and Material

The enemy had suffered a terrible defeat. His losses, says Eisenhower, since the campaign began had been enormous. The equivalent of five Panzer and 20 infantry divisions had been destroyed; six other Panzer and 12 other infantry divisions had been severely mauled. By Aug. 25, the Germans had lost 400,000 killed, wounded, or captured, including 200,000 prisoners, 135,000 of whom were taken between July 25 and Aug. 25. They had left 20,000 vehicles, 1,200 tanks, and 2,000 guns on the battlefield. In the face of these results, it seems absurd to speak of disappointment. Yet the fact remains that if 20,000 vehicles were caught, 30,000 crossed the Seine, the greater part of them by the single bridge left standing. The air forces were powerful smashers of towns, including some, like Caen and Lisieux, among the most beautiful in Europe, but they were a relatively clumsy instrument. They could not create a block on the Seine. Had a real block been created on the Seine the war would have been nearly over.

To some, the events which immediately followed made it appear that this was already the case. On crossing the Seine the Allies poured E. and N.E. like a flood. On the right, Patton's 3rd army raced through Reims and Verdun, crossing the Moselle and establishing itself on the E. bank from Nancy to the neighbourhood of Metz by Sept. 11. The U.S. 1st army under Hodges captured Liège on Sept. 8 and reached the German frontier by the 11th. The

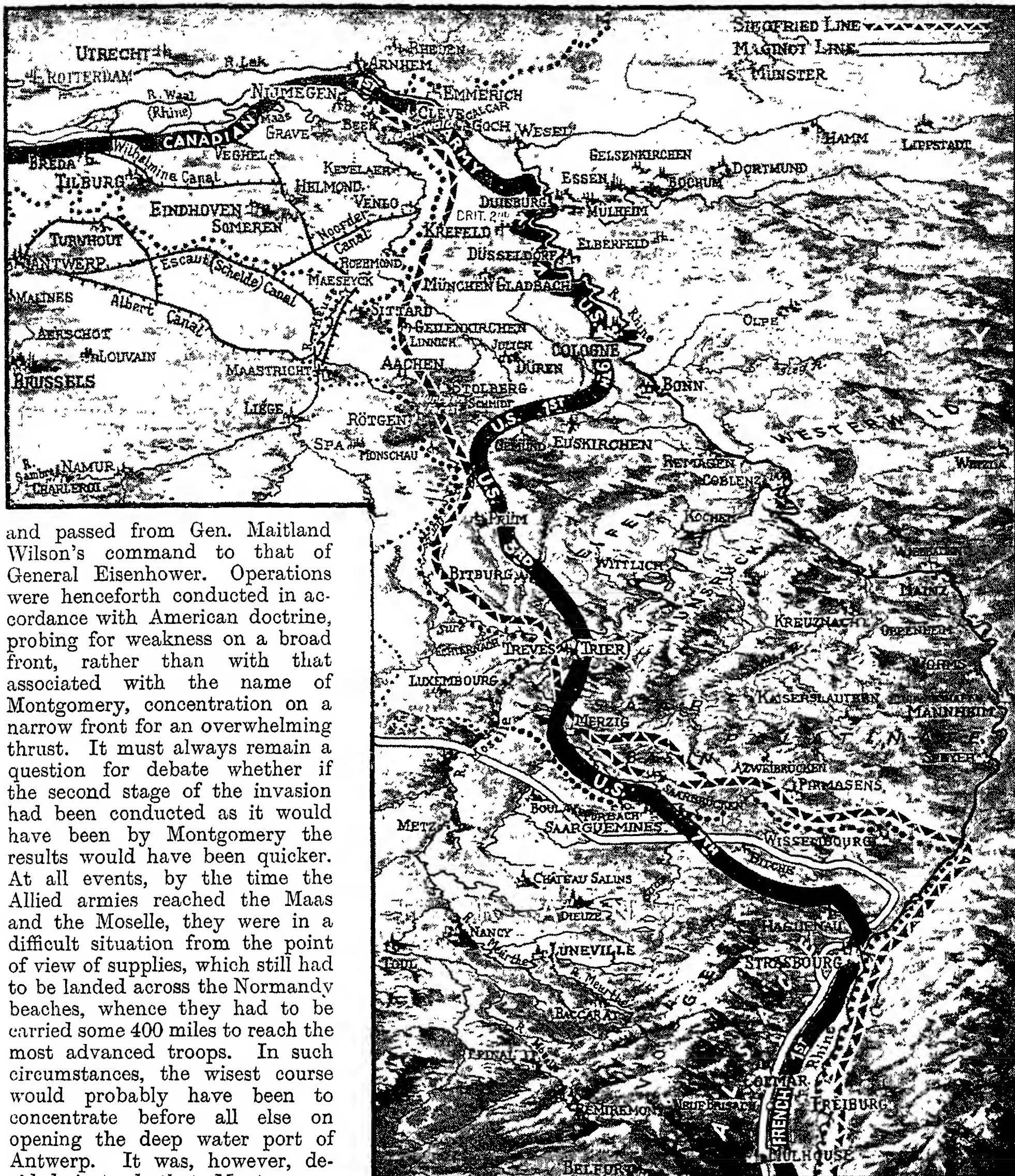
British 30th corps, as spearhead of the 21st army group, dashed away across the Somme, reaching Amiens on Aug. 31, Brussels on Sept. 3, and Antwerp on the 4th. Antwerp, one of the world's largest and best-equipped ports, was captured intact, but was of no value to the Allies while the Germans held the Schelde estuary.

During June and July some of the landing craft which had put the Allied armies ashore in Normandy made their way through the Strait of Gibraltar to Italy, to complete the fleet which on Aug. 15 landed on the S. coast of France the first troops of a new army, Gen. Patch's U.S. 7th, which included French troops. Landing W. of Cannes in good weather, the new expedition met but slight resistance. The "build-up" was far more rapid than in Normandy, later landings being unopposed.

While the French captured Toulon and Marseilles, the main body of Americans pressed up the Rhône. A small force also drove almost due N. from the landing places through the mountains to Grenoble, then wheeled into the Rhône valley to cut off the hostile forces fleeing up it. But this force was not strong enough for its task. The Germans had an armoured division, which broke through. The operation then became a pursuit. The Germans had lost heavily in prisoners, but their main body escaped and eventually joined the armies farther N. retreating towards the German frontier. The German forces in the S.W., harried by the French Forces of the Interior, fled north-eastward, but a considerable proportion of them were intercepted. By Sept. 11, when elements of the French 1st armoured division (serving with U.S. 7th army) made contact near Sombornon with the French 2nd armoured division (serving with the U.S. 3rd), the total of prisoners captured on both fronts was 395,000.

Eisenhower Assumes Personal Command

On Sept. 1 Eisenhower took over direct command of the Allied army groups in the N.—the 21st (or northern) group, consisting of the British 2nd and Canadian 1st armies under Montgomery, and the 12th (or central) group, consisting of the U.S. 1st, 3rd, and the recently formed 9th armies, under Bradley. On Sept. 15 the forces which had landed in the S. became the 6th (or southern) army group, under Gen. Devers,



and passed from Gen. Maitland Wilson's command to that of General Eisenhower. Operations were henceforth conducted in accordance with American doctrine, probing for weakness on a broad front, rather than with that associated with the name of Montgomery, concentration on a narrow front for an overwhelming thrust. It must always remain a question for debate whether if the second stage of the invasion had been conducted as it would have been by Montgomery the results would have been quicker. At all events, by the time the Allied armies reached the Maas and the Moselle, they were in a difficult situation from the point of view of supplies, which still had to be landed across the Normandy beaches, whence they had to be carried some 400 miles to reach the most advanced troops. In such circumstances, the wisest course would probably have been to concentrate before all else on opening the deep water port of Antwerp. It was, however, decided instead that Montgomery should make an attempt to jump the river barriers in front of him. His resources would not permit him to do both at once, particularly as the enemy was showing signs of recovering his balance.

Thus was initiated the battle of Arnhem, which began on Sept. 17. The essential feature was the dropping of a "carpet" of airborne troops, U.S. and British, across the successive waterways, the Maas, the Waal, and the Lower Rhine, on the axis of the main road from Eindhoven to Arnhem. Along the corridor thus formed the British 30th corps was to advance and

establish itself north of the Lower Rhine. The crossings of the Maas and Waal were secured, but that over the Lower Rhine at Arnhem had to be abandoned. (See Arnhem.) The advance was broken off, and the 21st army group set about clearing the West Schelde in order to bring the port of Antwerp into use.

The Germans had thrown garrisons tens of thousands strong into

the French ports in order to deny them to the Allies. Not all these garrisons made a strong resistance. Dieppe, which was to prove useful, was taken on Sept. 1, and Le Havre on Sept. 11. Brest held out until Sept. 19, by which time it was so badly damaged and so far from the fighting as to be of small value. The sweep up the Channe' coast, carried out by the Canadians, resulted not only in the capture of

Liberation of Western Europe : the Allies' line upon the Rhine. Map showing position of the Allied armies just before the fall of Cologne, March 6, 1945. On the 500-m. front were 21st army group (Canadian 1st, British 2nd, U.S. 9th), F.-M. Montgomery; 12th (Central) group (U.S. 1st and 3rd), Gen. Bradley; 6th (Southern) group (U.S. 7th, French 1st), Gen. Devers

valuable ports but also in the cessation of the bombardment of southern England by flying bombs (*q.v.*). On the capture of Boulogne (Sept. 23), a pipe-line was laid directly to it. Some of the ports, however, held out firmly. Dunkirk did not appear worth attacking, since its value was not likely to justify the losses involved, and its garrison surrendered only on May 11, 1945, after the general surrender. Bordeaux was liberated by the F.F.I. on Aug. 31, 1944, but the Germans held the Gironde estuary until, in April, 1945, the situation on the main front made it possible to send troops of the French 1st army to clear the position.

The opening of the W. Schelde, carried out by Canadian and British troops of the Canadian 1st army in the last week of Oct. and the first of Nov., was one of the most intricate and arduous operations undertaken in the whole course of the campaign. It involved a series of combined attacks by air, water, and land, and much use of amphibious equipment. The most difficult part of it was the capture of the island of Walcheren, most of which had been inundated by the breaching of the dykes by the R.A.F. (Oct. 3 and 7). Losses were heavy because it was seldom that the bombing put out of action the well-protected coast defences, and the Germans kept their guns in action up to the last.

Winter Campaign in Alsace

Antwerp was now open, and the railways were to a great extent restored, but this for the time being did not compensate for the bad weather, and for the opportunity to recover afforded to the enemy by the delay. During Nov. and early Dec. the troops laboured in heavy mud against the formidable Siegfried frontier defences. Losses were heavy, especially on the American front. Yet by Dec. 20, the French 1st army on the right had reached the Rhine, clearing Mulhouse on the 22nd; the French 2nd armoured division, still with the U.S. 7th army, entered Strasbourg on the 23rd; the Americans were pushing into the Saar, were beyond the Our (which forms the eastern frontier of Luxemburg), and were E. of Aachen; the British were holding the Maas.

The dispersion of Eisenhower's dispositions resulting from the dispersion of his attacks gave the enemy his chance for a riposte. Rundstedt, restored to supreme command after having been re-

lieved of it in Normandy, had gathered up a reserve, including some divisions from the eastern front. On Dec. 16 he struck on the most thinly held sector of the American front, between Echternach and Monschau. His object was to reach the Meuse, swing N. to take Liège, and penetrate as far as Brussels and Antwerp if all went well. He made use of three armies, two of them Panzer armies largely equipped with new Panther and Tiger tanks.

Battle of the Ardennes

The enemy smashed all resistance in his path and thrust deep into the Ardennes, creating a separation of left and right in Bradley's command which led to the placing temporarily under Montgomery of the U.S. 1st and 9th armies. The enemy achieved a maximum advance of over 50 m., but not at the old German speed. He was foiled by the manner in which the Allies covered and contained the flanks of the thrust, by the fine weather after Christmas which gave their air forces full scope, by the dogged resistance of the American troops, and in particular by the defence of the road junction of Bastogne, by the U.S. 101st airborne division, after it had been surrounded. When the Allies struck back he began to pull out again. This he did deliberately, and his rearguards fought so tenaciously that, though large numbers of prisoners were taken, he was never in any risk of being cut off. The denuding of the front in the Palatinate in order to reinforce the southern flank in the Ardennes enabled him to recover more ground here even while his main force was in full retreat, but this was not of the first importance. The battle of the Ardennes was substantially concluded by Jan. 16, 1945, and all remaining losses were soon recovered when the Allies had regrouped. This was the last German counterstroke. It cost the enemy 220,000 casualties and immense losses in tanks, guns, vehicles, aeroplanes, and achieved nothing decisive. It led to Rundstedt's replacement by F.-M. Kesselring—presumably in the hope that he would repeat the defensive success he had achieved in Italy.

Rundstedt had, however, delayed the Allies at least six weeks. They now used their recovery of the initiative to press on to the Rhine. Early in Feb. the Franco-American forces closed upon the river from the Swiss frontier to

Strasbourg. On March 15, Patton's 3rd army also advanced on the Rhine, crossing the Moselle just short of the confluence at Coblenz. On the same day, the U.S. 7th army struck northward between Saarbrücken and the Rhine. The big German pocket between the Rhine and the Moselle at once collapsed.

Farther north, the U.S. 1st army reached the Rhine at Cologne, which it captured on March 7. On that same day one of its columns, closing to the Rhine farther south, found the Ludendorff railway bridge at Remagen intact, and succeeded in crossing. This was an entirely unexpected gift, not allowed for in Eisenhower's plans; but these were immediately adapted to the new situation.

Struggle for the Rhine

Montgomery's army group (of which the U.S. 9th army still formed part) experienced the grimmest fighting in all this Rhineland operation. Its orders were to line up on the Rhine from Düsseldorf northwards. The British 30th corps, under the command of the Canadian 1st army, had to clear the Reichswald, between the Maas and the Rhine, with the aid of the U.S. 9th. There followed one of the fiercest struggles fought in the whole course of the war in the depths of the great waterlogged forest. The enemy cut the Roer dams before abandoning them, and the resulting floods delayed the 9th army's northward thrust; but the two armies linked on March 3. Except for a tenaciously held enemy bridgehead at Wesel, eliminated only a week later, the 21st army group had fulfilled its task.

"The whole of the Allied campaign west of the Rhine had gone according to plan to an extraordinary degree, and my fullest hopes were realized," says Gen. Eisenhower in his report. Chief of those hopes had been that the Germans would fight the decisive battle W. of the Rhine, to compel which the possibility of destroying the 31 Rhine bridges behind the enemy was considered, but abandoned as involving too great a diversion from the existing strategic air effort. The enemy had withdrawn; but he had suffered very heavy losses. He had not stood to the end, and had, with the skill which he had not yet lost, transferred a considerable proportion of his troops and material to the E. bank. Yet the war was almost as good as over. The dis-

persion of German war industries, a wise step when it was undertaken, had the disadvantage now, when bombs were raining upon his communications, that the enemy was finding it impossible to bring his equipment and warlike stores to the scene of action.

After a tremendous air and artillery bombardment, the passage of the Rhine by the British 2nd army began on the night of March 23. Next morning two airborne divisions, one British and one American, were landed beyond the Rhine north of Wesel, within range of supporting fire from the west bank, and after the heads of the columns of the land forces were already over the river. The U.S. 9th army also effected a crossing early on the 24th, against moderate resistance. The U.S. 1st army undertook an offensive south from its bridgehead at Remagen. The U.S. 3rd army got over on either side of Mainz.

Inequality of Opposing Forces

The opposing forces were now strikingly unequal in power and numbers. On the Allied side stood approximately 83 divisions, including the airborne—60 U.S., 16 British, and seven French. All but a few American divisions, held in reserve, were ready to march into Germany or the Netherlands. On the German side was a maximum of 56 divisions in being, many of them seriously under strength; the skeletons of several others; and a mass of hastily enrolled "home guards." In armament, the contrast was even greater. In the air the Allied advantage was overwhelming; in fact the last occasion when the Luftwaffe was seen in the air in strength was at the opening of the counter-offensive into the Ardennes. Nor was there any further heavy fighting by the standard of what had gone before.

The Allied bridging and engineering work in general was superlative, so that powerful striking forces were soon over the Rhine. The U.S. 1st and 9th armies enveloped the Ruhr area, making contact near Lippstadt on April 1; they trapped the whole of one German army group and two corps of another—a total of 21 divisions. Then deep thrusts, not seriously opposed, were made into the heart of Germany: the French towards the Swiss frontier, the U.S. 7th army towards Munich and the Brenner, the U.S. 3rd on Erfurt and then away down to the Danube below Regensburg and over the Czecho-Slovak frontier,

the U.S. 1st on Leipzig, the U.S. 9th on Brunswick, and the British 2nd on Bremen and Hamburg. The Canadian 1st army swung northward and by the middle of April, after heavy fighting, reached the sea north of Groningen, liberating the Netherlands east of the Zuyder Zee, but leaving strong German forces isolated in "Fortress Holland"—the provinces of N. and S. Holland.

No demarcation line was set in advance for the meeting of the Western Allies and the Russians, local commanders receiving orders to arrange a temporary boundary when contact was imminent. When the time came, this boundary was fixed in the central sector along the Elbe and Mulde rivers. On April 25 patrols of the U.S. 1st army established contact with Russian troops on the Elbe at Torgau.

Pushing along the Danube, the U.S. 3rd army advanced into Austria, entering Linz on May 5, while the 7th took Innsbruck on May 3 and made contact with the U.S. 5th army (see Italy, Campaign in) at Vipiteno beyond the Brenner. In the north, the British 2nd army, reinforced by a U.S. airborne corps, crossed the Elbe on April 29, outflanked Hamburg, and on May 2 reached the Baltic at Lübeck (cutting off the peninsula of Denmark), and made a junction with the Russians at Wismar. On May 4 a German delegation which came to Montgomery's headquarters signed an instrument of unconditional surrender of all naval, land, and air forces opposite the 21st army group. The final surrender of all the forces of the Reich was made to General Eisenhower at Reims on May 7. The military, political, and economic system of Germany had completely collapsed.

Victory Never in Doubt

From first to last, except for a brief period at the height of the counter-offensive in the Ardennes, the Allies had never lost the initiative. They had gone forward remorselessly, and victory had never been seriously in doubt. Their casualties had been heavy, those for the land forces numbering in dead, wounded, and missing 766,967 (American 514,534, British and Canadian 184,512, French 61,247, the balance being made up of Poles, Czechs, Belgians, and Dutch); but these casualties were far below those inflicted upon the enemy. Consult Report by the Supreme Commander to the Combined Chiefs of Staff on the Opera-

tions in Europe of the Allied Expeditionary Force, 1946; Report by the Supreme Commander, Mediterranean, to the Combined Chiefs of Staff on the Operations in Southern France 1946; Dispatch to the Secretary of State for War on Operations in N.W. Europe, June 6, 1944-May 5, 1945, by F.M. the Viscount Montgomery, 1946.

Cyril Falls

European Recovery Programme.

Programme to restore economic stability to post-war Europe with the help of financial aid from the U.S.A. The possibility of such aid, depending on a workable plan of European self-help, first broached tentatively by Dean Acheson, was outlined by George Marshall, U.S. secretary of state, in an unofficial speech at Harvard University on June 5, 1947. It could, he suggested, be part of the general U.S. policy directed against "hunger, poverty, desperation, and chaos." But the initiative, he insisted to a press conference a week later, must come from Europe, through joint action.

The British foreign secretary, Ernest Bevin, gave an immediate welcome to the "Marshall plan," and visited France to discuss ways of following up the American proposal. Russia refused to take part in an organization to work out a recovery programme, but the U.K. and France decided to go ahead, and on July 3 issued an invitation to 22 European countries, omitting only Germany (from which the commanders-in-chief of the four zones were invited), Spain, and Russia, to a conference in Paris on July 12. Refusals came from Albania, Bulgaria, Czecho-Slovakia (after an earlier acceptance), Finland, Hungary, Poland, Rumania, and Yugoslavia. Representatives of Austria, Belgium, Denmark, Eire, France, Greece, Iceland, Italy, Luxemburg, the Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, and the U.K. and of the three western occupying powers in Germany, met and set up a committee of economic cooperation. By Sept. this committee had drawn up for submission to the U.S. secretary of state a detailed statement, called the European Recovery Programme (E.R.P.), showing the assets and needs of the participating countries for the subsequent four years.

On Dec. 19, 1947, President Truman sent a message to congress recommending the E.R.P. and asking for \$17,000,000,000, to be paid out during April 1, 1948-June

30, 1952. Congress passed the Foreign Assistance Act on April 2, 1948. This act provided for \$5,300,000,000 (later reduced to \$4,000,000,000 by the Foreign Aid Appropriation Act of June 14) to be spent on European recovery during the first twelve months of the plan. The economic co-operation administration (E.C.A.) with Paul G. Hoffman as administrator, was set up to administer Marshall aid.

At a second conference in Paris, March-April, 1948, the Marshall aid countries set up, April 16, a permanent representative body, the organization for European economic cooperation (O.E.E.C.). Bilateral agreements were made between the U.S.A. and each of the 16 cooperating countries, and on Oct. 16 the O.E.E.C. presented their recovery plans to Averell Harriman, the E.C.A.'s special representative in Europe. These envisaged greatly increased production in agriculture and industry, increased trade among the member countries, limitation of imports paid for in dollars to goods necessary to recovery, and increase in exports to dollar countries. Further acts providing funds for E.R.P. were passed by congress in 1949 and 1950.

Representatives of the W. German Federal Republic were admitted to the O.E.E.C., Oct., 1949.

In Dec., 1950, the trading position of the U.K. had improved to a point at which it was able to suspend acceptance of Marshall aid from Jan. 1, 1951. Total allotment made to it to that date was \$2,694,300,000. Marshall aid to the Irish Republic was suspended May 2, 1951, and to Sweden and Portugal, July 31, 1951. When E.R.P. and E.C.A. came to an end, Dec. 31, 1951, E.C.A. had allocated about 12,500 million dollars to Europe through the E.R.P. Consult The Marshall Plan and its Meaning, H. B. Price, 1955.

European Unification. Advocacy of unity in Europe, sometimes called Europeanism, is based on the historical fact that the unifying Roman Empire gave peace, civilization, and prosperity to the backward and warring tribes it brought under its sway. George of Podibradý (1420-71), Maximilien, duc de Sully (1559-1641), Hugo Grotius (1583-1645), Immanuel Kant (1724-1814), the Comte de Saint-Simon (1760-1825) are among notable advocates of the idea.

In the 20th century, Count Richard Coudenhove-Kalergi (*q.v.*),

with the backing of outstanding Europeans, made a new approach to the problem in his Paneuropa, 1923. An international group of economists and statesmen, formed by Edgar Stern-Rubarth with the help of the Hungarian E. Bleier and the Frenchman L. Coquet, and under Briand's chairmanship, worked for a European customs union. The Oslo Convention (*q.v.*), 1930, was an attempt to lay the foundations of such a union. The rise of Nazi-Fascist systems of government and the outbreak of war stopped practical extension of the idea, but not of the idea itself, for events and pressures during and after the Second Great War led during the years that followed it to some measure of unification in western Europe. Its military aspect was represented by Western Union (*q.v.*), the outcome of the Brussels Treaty of 1948. In the economic sphere it started with Benelux, a plan entered into in London in 1944 for a customs union after the war between Belgium, the Netherlands, and Luxembourg.

The winding up of the European Recovery Programme (*v.s.*), a striking effort of international co-operation, left in being the ORGANIZATION FOR EUROPEAN ECONOMIC COOPERATION (O.E.E.C.) and the EUROPEAN PAYMENTS UNION, a currency pool set up in 1950 to replace existing bilateral trade agreements with a multi-lateral system of payments. The E.P.U., in effect, set up a European clearing house and a common currency of account (unit 0.888671 gm. fine gold, the gold value of one U.S. dollar), all European currencies becoming convertible among themselves through this medium. The working capital of some 400 million dollars was provided by the U.S.A. under the European recovery programme. Each member was allotted a quota (the sterling area counting as one member for this purpose), within which payments, surpluses, and deficits were to be settled by credits and gold payments; and each member received from, and granted to, the Union a credit equal to 60 p.c. of its quota.

On the political side the Council of Europe (*q.v.*) came into being, and from discussion at its second meeting of the "Schuman plan" for the integration of European coal and steel industries put forward by Robert Schuman (then French foreign minister) developed the EUROPEAN COAL AND STEEL COMMUNITY, important both

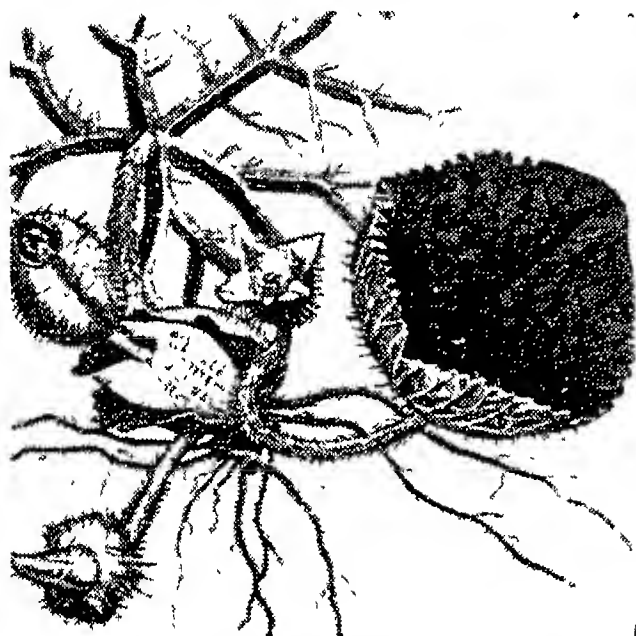
politically and economically. A treaty establishing the community, signed 1951 by France, the (W.) German Federal Republic, Italy, Belgium, the Netherlands, and Luxemburg, was ratified in 1952. It set up a council of ministers (the foreign ministers of the six countries), a high authority of nine (a president, two vice-presidents, and six members), a court of justice, and an assembly of 78 members. The organization resembled that of the Council of Europe, with which it had close links. A common market for coal, iron ore, scrap, and steel among the six member countries came into operation during 1953. The U.K. took no part in setting up the E.C.S.C., but sent a permanent delegation to its high authority to facilitate close association between the community and the U.K. and to deal with problems of common interest.

The six nations linked in the European Coal and Steel Community continued to develop cooperation among themselves; and in 1957 signed the so-called "Euratom" treaty which, on ratification, would abolish all import and customs duties in mutual trade in nuclear and mineral materials. They were also negotiating agreement on the establishment of a common market covering all trade between them.

Europium. Chemical element, one of the terbium family of rare earths, moderately soluble in a saturated solution of potassium sulphate. Demarçay isolated the nitrate by fractional crystallisation in 1896, Crookes having noticed a red band in the phosphorescent spectrum of a fractionated yttria earth. In 1939 Trombe separated 98 p.c. pure europium by a process of distillation in argon under pressure from the electrolytically prepared alloy with cadmium. This metal has the same hardness as neodymium and a melting point between 1,100-1,200° C. The atomic weight as determined by the mass spectrograph is 151.89 and by the analysis of pure europous chloride 151.96. The atomic number is 63. Europium has a body centred cubic structure. Europia, Eu_2O_3 , is a pale pink powder. It forms a hydroxide, chloride, dichloride, oxychloride, sulphate, carbonate, and nitrate. Traces may be separated from gadolinium by the action of dilute sodium amalgam under acid conditions.

Euryalē. In Greek mythology, one of the Gorgons (*q.v.*).

Euryale ferox. Aquatic perennial herb of the family Nymphaeaceae, native to the E. Indies. Its circular floating leaves are 1 ft. to 4 ft. in diameter, the rich purple underside, like the sepals of the purple flower, being protected by numerous spines. The fruit is a round berry containing numerous edible seeds, for which the Chinese cultivate the plant.



Euryale ferox. Leaves and flowers of this East Indies aquatic plant

Eurydice. In Greek mythology, wife of the poet Orpheus. When she died Orpheus went down into Hades, and by the power of his lyre induced Pluto, ruler of the underworld, to restore his wife to him, on condition that Orpheus did not look behind until he reached the earth again. In his eagerness to see if his wife were following, he forgot the condition, and Eurydice was lost to him for ever. *Pron.* u-riddi-see.

Eurymedon. Ancient name of the Köprü Su, a river of Pamphylia, Asia Minor. It flowed into the Mediterranean, W. of the Taurus Mts., and at its mouth the Athenians under Cimon defeated the Persians 466 B.C.

Eurypterida (Gr. *eurys*, broad; *pteron*, wing). Extinct scorpion-like animals of the class Arachnida. The body was rather flat, up to 6 ft. long, and covered by a thin horny covering (carapace) ornamented by fine, scale-like markings. The head was semicircular, consisting of six segments fused together, and six pairs of appendages were attached to the head-shield, the last pair being adapted as swimming paddles. The long abdominal portion had 12 segments, the first six bearing plate-like appendages with leaf-like gills. The last segment was a tail-plate, sometimes produced into a long spine. The upper surface of the head-shield had two eye-spots near the centre, and a large pair of faceted eyes near the margin.

Eurypterids originally inhabited the sea, but became adapted to brackish and possibly to freshwater conditions. Fossils are found in Silurian, Devonian, and Carboniferous strata.

Eusebius (c. 264–340). Church historian. Often called Eusebius Pamphili, he was probably a native of Palestine and spent his youth at Caesarea. After the martyrdom under Diocletian of his teacher Pamphilus, he took refuge in Egypt, and about 313 was appointed bishop of Caesarea by the emperor Constantine the Great. At the council of Nicaea, 325, though himself orthodox, he showed leanings towards the Arian party. His historical writings, especially *Praeparatio Evangelica*, *Demonstratio Evangelica*, and *Historia Ecclesiastica* (Eng. trans. 1890), entitle him to be called the father of ecclesiastical history.

Eustachian Tube. Tube leading from the upper part of the pharynx to the tympanic cavity of the ear. Its function is to maintain equal atmospheric pressure on both sides of the ear-drum. It is ordinarily closed, but is opened by each act of swallowing. Blocking of the tube, as in catarrhal conditions or from the growth of adenoids, leads to bulging of the membrane and partial deafness. The tube is named after Bartolommeo Eustachio (d. 1574), an Italian anatomist.

Eustachian Valve. The valve guarding, on the right, the opening of the great veins into the auricle of the heart. It is derived from the remains of the right sino-auricular valve of the generalised vertebrate form. It assists in preventing the reflux of blood when the right auricle contracts.

Eustatic Movements. In geology and geography, world-wide changes in sea-level, in contradistinction to apparent changes resulting from movements of the land. The removal of water from the oceans to form the great ice-sheets of the Pleistocene period caused a lowering of sea-level of 300 ft. or more. As the ice melted the water returned to the oceans and the level was raised once more. Eustatic movements have influenced the development of coral islands.

Eutaw Springs. River of S. Carolina, U.S.A., a tributary of the Santee river. Near here on Sept. 8, 1781, during the War of American Independence, the colonial force under General Greene gained an early success over the British under General Stuart, who

successfully withstood a second onslaught.

Eutectic (Gr. *eu*, well; *tēkein*, to melt). A condition of chemical equilibrium. The lowering of the freezing point of water by the addition of common salt was investigated by Raoult. Guthrie in 1878 discovered that at a certain temperature, -22°C ., and concentration, 23.5 p.c. of salt, the solution solidified completely as one mass. He called this type of mixture a eutectic and, for any two substances, the temperature and concentration remain constant. The term is used widely in connexion with the freezing and melting of alloys. If two metals are completely soluble in each other in the liquid state, but are either partly or wholly insoluble in the solid state, they may form a eutectic.

Eutectoid. Essentially similar to a eutectic (*v.s.*), a eutectoid is formed entirely in the solid state. Just as a molten solution of two metals may break up into two types of crystal when it becomes solid, so a solid solution may break up into two different, but closely admixed, constituents.

Euterpē (Gr., the well-pleasing). One of the muses (*q.v.*).

Euthanasia (Gr. *eu*, well; *thanatos*, death). Easy or comfortable death; in medical language, the use of means calculated to render the death of those suffering from painful and incurable diseases as painless as possible. Induced euthanasia was advocated by Plato, and was common under the Roman emperors, many of Pliny's friends being recorded as submitting to it. In the island of Ceos, in the Cyclades, euthanasia was enjoined on citizens over 60. It is said that in ancient Marseilles the authorities were memorialised in cases of serious illness, or even of dire misfortune, as to the advisability of euthanasia. In More's ideal state, Utopia, euthanasia was practised.

Eutropius. Roman historian of the 4th century A.D. Secretary to the emperor Julian, he was the author of *Breviarium ab Urbe Condita*, a short history of Rome from its foundation to 364. The work has little historical value but the simplicity of its style has made it a favourite text-book for beginners in Latin.

Eutyches (*fl.* 5th century A.D.). Founder of the Eutychian heresy. Superior of a monastery at Constantinople, he taught that the human nature of Christ was absorbed in the divine, and there-

fore non-existent, even His body not being truly human. For this he was condemned by a synod at Constantinople in 448, restored by the "Robber" council of Ephesus in 449, but finally condemned by the council of Chalcedon in 451, and afterwards banished. *Pron. U-ty-keez.*

Euxine. Ancient name of the Black Sea, the Pontus Euxinus, or hospitable sea. It was originally called Axenos, inhospitable, from the prevalent storms, and the hatred of strangers shown by the dwellers on the coasts. The name was probably changed when increasing commerce and the establishment of Greek colonies made it better known. *See Black Sea.*

Evacuation (Lat. *evacuo*, I empty). Military term for the act of withdrawing from a position. It was also applied to the movement of the civil population from areas threatened with aerial bombardment or invasion during the Second Great War. In Great Britain, under plans already prepared, evacuation from the London area began on Sept. 1, 1939. In four days some 370,000 children accompanied by their teachers, and nearly 280,000 others with their mothers, left the metropolis. Altogether 1,270,000 people went from 81 evacuation areas to 1,100 reception areas, chiefly in Lancs, Yorks, Derbyshire, Wales. This number rose to 1,341,000 in February, 1941. Under the government scheme for the evacuation of children between the ages of five and 16 to the British dominions, some 2,650 had reached their temporary homes in other countries before the sinking of the liner City of Benares on Sept. 17, 1940, when 77 children bound for Canada perished, caused the government to suspend the scheme.

Many government departments, banks, business houses, and sections of the B.B.C. moved out of London; and thousands left the threatened areas privately. Abroad 15,000 women and children were moved from Gibraltar in 1940, some 11,000 to the U.K.

Many "evacuees" returned to London during 1942-44; but the flying bombs caused a second mass evacuation, some 280,000 leaving London, July 2-Aug. 8, 1944.

Govt. sponsored return to evacuation areas in the N., W., Midlands, and S.W. began in Sept., 1944; to E. Anglia in March, and to London, Hull, and Grimsby in May, 1945. By July, 1945, only 76,000 remained in reception areas; by April, 1948, when the last count

was taken, 3,567. The scheme ended July 5, 1948, when the home secretary, under the Children Act, became responsible for unaccompanied children, and old people in hostels and the physically handicapped came under the provisions of the National Assistance Act. Allied air attack on W. Germany and Berlin led to the evacuation of millions to Silesia, Poland, Czecho-Slovakia, and Austria.

Evagoras (d. 374 B.C.). King of Salamis in Cyprus. Seizing the throne c. 410, he developed the naval power of his kingdom. He was on friendly terms with the Athenians, especially with the Athenian admiral Conon (*q.v.*), and it was due to him that Conon was helped by the Persian fleet at Cnidus (*q.v.*) in 394. Subsequently, in the war between Evagoras and the Persians, the Athenian fleet came to his aid. The war with Persia dragged on for several years, and was eventually ended by a settlement which guaranteed to Evagoras his kingdom. He was murdered by a courtier.

Evagrius (c. 536-600). Byzantine eccles. historian. Born at Epiphania, in Coele-Syria, he flourished during the reigns of the emperors Tiberius and Maurice. At first he studied law at Antioch, whence his surname Scholasticus (advocate). One of the continuators of Eusebius, his history covers the period from the council of Ephesus, 431, down to 593. It throws light chiefly on the religious controversies of the period.

Evander. A legendary Italian hero. Some time before the Trojan war he was said to have conducted a band of colonists from Pallantium in Arcadia to Italy, where he founded a settlement on the Palatine hill. Writing and other arts and the institution of the Lupercalia in honour of the Arcadian god, Pan, were ascribed to him. Evander, who figures in the Aeneid of Virgil, is really the Italian Faunus (the favourable one), to whom the Greek Pan also corresponds, and the story of the Arcadian colony, like much in Roman mythology and legend, is due to Greek influence.

Evangelical (Gr. *evangelikos*, of the Gospel). Term applied to the religious revival within and without the Anglican Church in the 18th century. The movement was started by John and Charles Wesley and George Whitefield. They had all been members of the Holy Club at Oxford (1729-35). In 1738 John Wesley experienced conversion at the Moravian chapel

in Aldersgate, and shortly afterwards, following Whitefield's example, he began open air preaching at Bristol, at Moorfields, and Kennington, and up and down the country for the rest of his life. His followers broke away from the Established Church after Wesley's death, and formed the Methodist or Wesleyan Churches. (*See Methodism.*)

Other leaders in the 18th century were Romaine (S. Dunstan's, Fleet St.); Henry Venn (Huddersfield); Grimshaw (Haworth); Fletcher (Madeley); Walker (Truro); Berridge (Everton, Beds); Newton (S. Mary Woolnoth, Lombard St.); Scott (Olney); John Thornton, the banker; and Cowper the poet, who with Charles Wesley, Toplady, Cecil, and others created modern hymnology. In the 19th century the leading men were Charles Simeon, who carried on work in Cambridge already begun by Isaac Milner; Dale (S. Bride's, Fleet St.); Daniel Wilson (Islington); McNeile (Liverpool); Stowell (Manchester); and especially John Venn, and the six laymen Henry Thornton, William Wilberforce, Charles Grant, James Stephen, Zachary Macaulay, and Lord Teignmouth, who formed the Clapham sect.

The movement promoted Sunday Schools (Hannah More), benevolent societies, a revival of parochial life, the training of candidates for the ministry, the distribution of the Bible, pastoral work in big towns, missionary work abroad, the abolition of the slave trade (Wilberforce and Buxton) and the passing of the first Factory Acts (Lord Shaftesbury). These different activities were mainly carried on by big societies founded at the turn of the 18th and 19th centuries—Church Missionary, Bible, and Religious Tract Societies. Later came the London Jews, Church Pastoral Aid Society, Church Association, Y.M.C.A., Y.W.C.A., etc.

The Evangelicals emphasised original sin, the efficacy of the Atonement, the need of personal conversion, justification by faith, and veneration for the letter of the Scriptures. What is known to-day as the Low Church party in the Church of England (to be distinguished from the Low Church party of the period preceding the Evangelical revivals) is usually called evangelical. Its leaders meet annually at the Keswick Convention and the Oxford and Islington Conferences. The term evangelical is applied to the United Lutheran

and Reformed Church in Germany and to the Protestants of France. It forms part of the title of the World's Evangelical Alliance (*q.v.*) and of similar organizations in America. In the 20th century the Anglican Evangelical Group Movement was founded and led by Canon Storr of Westminster, to promote more liberal and scholarly teaching of the earlier doctrines of the movement. Consult *The Evangelical Revival in the 18th Century*, J. H. Overton, 1909; *History of the Evangelical Party in the Church of England*, G. R. Balleine, 1929.

Evangelical Union OR MORISONIANS. Scottish Presbyterian body. It was founded by the Rev. James Morison of Kilmarnock and other seceders from the United Secession Church in 1843. Soon afterwards they were joined by ministers expelled from the Congregational Union. They rejected the doctrine of predestination, and maintained universal redemption and the freedom of the will. The churches were independent and free to adopt Presbyterian or Congregational forms of government. All ministers had to be total abstiners. The bulk of the congregations joined the Congregational Union (of Scotland) in 1896.

Evangeline. Narrative idyllic poem by H. W. Longfellow. First published in 1847, the story is a romantic account of the deportations in 1755 of the French Acadians from Acadie (Nova Scotia), owing to their lack of sympathy with their British and Protestant rulers. It is a tender, tragic romance, beautifully told, and one of the most successful instances in English of the sustained use of hexameters. The poem is named from the heroine, who was first to have been Gabrielle, a name later adapted as Gabriel for the hero.

Evangelist (Gr. *evangelistēs*, proclaimer of glad tidings). Originally one chosen by the apostles to preach the Gospel where it was unknown. Theodoret first restricted the name to travelling preachers; Oecumenius first applied it to the authors of the four Gospels; today it is also used for missionaries and revivalist preachers. (Consult Eph. 4; Acts 8 and 21; 2 Tim. 4.) The four living creatures referred to in Ezek. 1 and 10, and Rev. 4, were regarded by Jerome as symbols of the four evangelists—the man, Matthew; the lion, Mark; the ox, Luke; the eagle, John. Irenaeus assigned the lion to John and the eagle to Mark; Augustine and Bede, the lion to

Matthew and the man to Mark. Evangelist is the character who first shows the way to Christian in Bunyan's *Pilgrim's Progress*. See *Apostle*; *Gospel*; *Preaching*.

Evans, Sir Arthur John (1851–1941). A British archaeologist. Eldest son of Sir John Evans (*q.v.*), he was born July 8, 1851, at Hemel Hempstead, and went from Harrow to Brasenose College, and Göttingen. As a young man he travelled in the Balkans. He was keeper of the Ashmolean Museum, Oxford, 1884–1908, and under him it became an institution worthy of its academic and national position. In 1890 he published his work on the "Late Celtic" urnfield at Aylesford in Kent, of epoch-making importance in British Iron-Age studies. He then turned his attention increasingly to prehistoric Aegean civil-



Sir Arthur Evans,
British archaeologist

ization, and in 1894 published *Cretan Pictographs*, drawing attention to an unknown script on carved seal-stones from Crete. In 1899 he began the excavations at Knossus (Knossos) in Crete which revealed an unknown civilization earlier than the Mycenaean, spanning the whole Mediterranean Bronze Age. To it he gave the name Minoan (see *under* Aegean Civilization). He published the results of these excavations in *The Palace of Minos at Knossos*, 4 vols., 1921–35. Evans, who was knighted 1911, died July 11, 1941.

Evans, Caradoc (1879–1945). Welsh novelist and journalist. The son of a Carmarthen auctioneer, he was born at Pantycroy, Llandyssul, and left school at 13 to be apprenticed to a linen draper. During the First Great War his vituperative references to the Welsh in *My People*, 1915, and *Capel Sion*, 1916, incensed his fellow countrymen. A copy of his play, *Taffy*, 1923, was publicly burned in a refuse destructor at Barry. A novel, *Morgan Bible*, 1943, was followed posthumously by *Mother's Marvel*, 1949. Evans was editor of *T.P.'s* and *Cassell's Weekly* in 1925. He died at Aberystwyth, Jan. 11, 1945. His second wife, Countess Barcynska (Oliver Sandys), wrote his biography in 1946.

Evans, Dame Edith (b. 1888). British actress. She was born in

London, Feb. 8, 1888, and made her first professional appearance on the stage as Cressida at the



Dame Edith Evans,
British actress

King's Hall, Covent Garden, 1912. After touring with Ellen Terry in Shakespearian repertory, she appeared in *My Lady's Dress* in 1920, and the following years scored a great personal success as Lady Utterword in *Heartbreak House*. This was one of many parts she created; others were those of *The Serpent* and *The She-Ancient* in *Back to Methuselah* (*q.v.*); *Florence Nightingale* in *The Lady with a Lamp*; *Orinthia* in *The Apple Cart*; *Gweny* in *The Late Christopher Bean*. Distinguished performances which must also be accounted *tours de force* included those as the Nurse in *Romeo and Juliet*; *Rosalind* in *As You Like It*; *Millamant* in *The Way of the World*; *Lady Pitts* in *Daphne Laureola*; *Lady Bracknell* in a revival of *The Importance of Being Earnest*. Her film début was in *the Queen of Spades*, 1949. A versatile as well as a brilliant actress, Dame Edith (cr. 1946) displayed a mastery of technique and a genius for artificial comedy.

Evans, Edward Ratcliffe GARTH RUSSELL (b. 1881). British sailor. Known as Evans of the Broke, he was raised to the peerage Oct., 1945, as Baron Mountevans (*q.v.*) of Chelsea.

Evans, Sir George de Lacy (1787–1870). British soldier. Born at Moig, co. Limerick, he entered the Indian army in 1806, and in 1812 he joined the 3rd Dragoons in the Peninsula. In 1835–37 he commanded the legion recruited in England to assist Queen Isabella of Spain against the Carlists. Though ill-equipped and neglected by the Spanish government, it fought well. Evans was knighted 1839, promoted general 1861, and died Jan. 9, 1870.

Evans, Sir John (1823–1908). British archaeologist and numismatist. Born at Britwell Court, Bucks, Nov. 17, 1823, in 1840 he entered his uncle's paper mills at Hemel Hempstead. Admitted a fellow 1861, he was treasurer of the Royal Society, 1878–98. He was president of the Geological Society, 1874–76; the Numismatic Society, 1874–1908; the Society of An-

tiquaries, 1885-92; and the Anthropological Institute, 1877-79. In 1859 he accompanied Sir Joseph Prestwich to examine alleged flint implements found in the gravels of the Somme valley by Boucher de Perthes. They were able to demonstrate before the Royal Society that these were genuine and thus to establish the existence of Palaeolithic Man. Evans, who was knighted in 1892 and died May 31, 1908, built up a notable coin collection subsequently divided between the British Museum and the Ashmolean, Oxford.

Evans, MARIAN OR MARY ANN (1819-80). Maiden name of the British novelist who wrote as George Eliot (*q.v.*).

Evans, OLIVER (1755-1819). American inventor. Born at Newport, Delaware, he entered his brother's milling business, and invented machinery worked by water power that halved the labour required in the grinding of corn. He also invented a card-making machine; Americans claim that he designed the first steam engine on the high-pressure principle. He was an ingenious mechanic. He died at New York, April 16, 1819.

Evanston. City of Illinois, U.S.A., in Cook co. It stands on Lake Michigan, 13 m. N. of Chicago, of which it is a residential suburb, and is served by rlys. The seat of North Western university, it was settled in 1835, incorporated 1863, and chartered as a city 1892. It makes glass products, dairy equipment, and paint; and processes fruit and vegetable juices. Pop. (1950) 73,641.

Evansville. City of Indiana, U.S.A., the co. seat of Vanderburgh co. On the Ohio river, 185 m. S.W. of Indianapolis; it is served by rlys. and an airport. A port of entry, it trades in coal, flour, and tobacco, and has cotton, woollen, and flour mills, meat packing plants, stockyards, foundries, machinery works, and cigar, glass, and leather factories. The Mead Johnson terminal provides for the interchange of river, rail, and road traffic. Evansville dates from 1817 and became a city in 1847. Pop. (1950) 128,636.

Evaporation (Lat. *e*, from, out; *vapor*, vapour). Name commonly given to the process by which a liquid, and less commonly a solid such as carbonic acid snow, changes into a state of vapour. Evaporation may be said to be a function of heat and pressure. Liquids may evaporate at all temperatures; under the application

of heat or the removal of pressure from their surfaces, they evaporate more quickly. At a given temperature evaporation in a closed vessel ceases when a certain pressure of vapour is attained, for thin condensation of the vapour balances the evaporation of the liquid.

The rate of evaporation of a liquid depends upon the area of the surface exposed, the freedom of the space surrounding it from vapour, and the difference between the vapour pressure and the external pressure. Thus a given volume of a liquid evaporates more quickly in a shallow dish than a deep one, in a dry atmosphere than a damp one, and on a warm day than a cold one. The movement of the atmosphere over the surface of the liquid also increases the rate of evaporation, as the evaporated particles are carried away.

In converting a liquid into a vapour at the same temperature, heat has to be supplied. In other words, heat is absorbed in the process of evaporation. Evaporation thus produces a cooling effect, and this is the basis of refrigeration in certain types of ice-making machines. The quantity of heat that has to be supplied to one gram of liquid at the boiling point without changing its temperature is called the latent heat of vaporisation. This is the same thing as the quantity of heat given out by one gram of the vapour at boiling point, when condensing to a liquid at the same temperature.

Evaporation of water is of great importance in nature. It has been shown that the atmosphere gains as much from green grass-covered soil as from a water surface. Evaporation is at a maximum during the summer months owing to high surface temperatures, winds, and increased water-holding ability of the warmer air. On foggy winter days condensation rather than evaporation may be the rule. When percolation into the soil is small, evaporation is given by the difference between rainfall and run-off. See Boiling Point; Condenser; Heat.

Evaporation Value. Method by which the relative values of different fuels may be expressed. It consists in stating the amount of water which each is capable of converting into steam when the fuel is burnt under specified conditions. Thus one pound of average coal can theoretically convert 15 pounds of water at boiling temperature in the atmosphere into steam; while under the same conditions petroleum would convert

21 pounds, and ordinary dry straw 8½ pounds. These figures represent evaporation values. See Fuel.

Evaporimeter. An instrument for measuring rate of evaporation of water from a surface to the atmosphere. The most direct method of determining evaporation from a free water surface comprises observation of the level of water in a sunken tank, allowance being made for rainfall (*e.g.* Symons evaporimeter). Other evaporimeters are concerned with evaporation from natural grass and earth surfaces.

Evatt, HERBERT VERE (b. 1894). Australian politician. He was born April 30, 1894, at East



Maitland, N.S.W., and educated at St. Andrew's college and Sydney university. Having been tutor in philosophy at St. Andrew's and lecturer in legal interpretation at Sydney, he was a Labour member of the N.S.W. legislative assembly, 1925-29. A justice of the federal high court, 1930-1940, he became attorney-general and minister for external affairs in 1941, representing his country at discussions of the Pacific war situation in Washington and Paris, at the San Francisco conference, and at the Paris peace conference. In 1946 he was appointed deputy prime minister. He attended the conference of Commonwealth prime ministers in London, Oct., 1948, and in the same year was chairman of the U.N. general assembly in Paris. He lost office with the electoral defeat of his party in 1949. Evatt published *Australia in World Affairs*, 1946.

Eve. Name of the first woman in the Biblical story of creation. In Hebrew the form of the name is Chawwah. It was given to the woman by Adam (Gen. 3, v. 20), and is explained as meaning "living" or "life." She was so called, it is stated, because she was the mother of all living. See Adam; Creation.

Evection (Lat. *e*, out; *vehere*, to carry). Inequality of the moon's motion, which increases or diminishes the mean longitude of the moon to the extent of 1 deg. 16 mins. at maximum.

Evelina. Fanny Burney's first novel. The first avowed novel of society, it was published anonymously in 1778 under the title of

Evelina; or a Young Lady's Entrance into the World. Johnson declared that there were passages in it which might do honour to Richardson.

Evelyn, JOHN (1620–1706). English author and diarist. He was born at Wotton House, Surrey, Oct. 31, 1620,

educated at Lewes and Balliol College, Oxford, and became a student of the Middle Temple. Possessing ample means, he remained abroad during the greater part of the Civil War. A sincere royalist and churchman, his admiration for Charles II in exile did not blind him to the king's faults when, after the restoration, Evelyn enjoyed favour at court.

During 1653–94 Evelyn was settled at Sayes Court, Deptford, where he transformed a rude orchard and field of 100 acres into a pleasure of notable charm. He befriended Jeremy Taylor and other divines, and was on terms of intimacy with Bentley, Boyle, Pepys, Grinling Gibbons, and Hollar. He helped to found the Royal Society, and was its secretary in 1672. He was a commissioner for the rebuilding of St. Paul's Cathedral; aided church establishment in the plantations; was a commissioner of the privy seal, 1685–87; and treasurer of Greenwich Hospital, 1695–1703. In addition to gardening and forestry, he took an active interest in agriculture, architecture, art, engraving, music, and navigation. His *Sylva*, 1664, first drew attention to the importance of afforestation in England; *Terra*, 1676, was a first attempt in English at a scientific study of agriculture; *Sculptura*, 1662, a work on engraving, was suggested by Boyle. He wrote a *Character of England*, 1659, a *Life of Mrs. Godolphin* (a friend of many years), a discourse on Medals, and a *History of the Dutch War*, which is lost.

He is best remembered for his *Diary*, 1620–1706 (more properly memoirs), a work valuable for its reflection of the political, social, and religious life of his time. Descriptions of the fire of 1666 and the great storm of 1703 show that he could write vividly. The MS was in danger of destruction when, at the suggestion of William Upcott,



After Holl

a selection from it, ed. by William Bray, was published in 1818 (it was not published in full until 1955, 6 vols., ed. E. S. de Beer). After 1694 Evelyn lived at Wotton, where he died, Feb. 27, 1706, and was buried in the chapel. He is well described as a patriot who kept his loyalty in dangerous times, a Christian who preserved his integrity in the most immoral, and a philosopher who viewed every object with a desire to extract from it all its beauty and goodness. *Consult* Lives. H. B. Wheatley, 1906; Lord Ponsonby, 1934; H. S. Hiscock, 1955.

Evening News, THE. London evening newspaper. Started in 1881 in the Conservative interest as a rival to *The Echo*, in 1889 it absorbed *The Evening Post*, founded 1887. In 1894 it was acquired for £25,000 by a new company of which Alfred Harmsworth (Viscount Northcliffe), Harold Harmsworth (Viscount Rothermere), and Kennedy Jones were the proprietors. Under the new direction it emerged from an almost moribund concern into a property yielding in the first year a profit of £14,000 and in the second £25,000. Its ever-increasing success—it had in 1947 a net sale of 1,641,394—led to the foundation of *The Daily Mail*. From 1894 until 1896 Kennedy Jones was editor; he was succeeded by W. J. Evans. F. L. FitzHugh was editor 21 years, retiring in 1944. Prominent regular contributors have included Claude Burton (C. E. B.), Oswald Barron (*The Londoner*), the cartoonist P. H. Fearon (*Poy*), Arthur Machen, Sir John Squire, Frank Swinnerton, Frances Pitt, and the humorous artist Joseph Lee. It is issued by The Associated Newspapers, Ltd. *See* Northcliffe, Viscount.

Evening Primrose (*Oenothera biennis*). Biennial herb of the family Onagraceae. It is a native



Evening Primrose, a biennial herb

of N. America. The leaves are oblong-lance-shaped; the flowering stem (2nd year), 4 ft. or 5 ft. high, branched, with narrower, toothed leaves, terminates in a long spike of large, pale yellow flowers, opening in the evening. The variety *lamarckiana* has much larger flowers than the type form, and has been much studied. *See* Mutation.

Evening Schools. Term specifically given to evening classes established in the United Kingdom, mainly during the first half of the 19th century, for giving elementary instruction to illiterate adults. One of the earliest was started at Bala, N. Wales, in 1811. The system was warmly supported by Bishop Hinds in 1839, and was adopted by the Ragged School Union, founded 1844, and known since 1898 as the Shaftesbury Society. The term is still unofficially applied to schools in which pupils beyond the compulsory school age may continue to study. *See* Further Education.

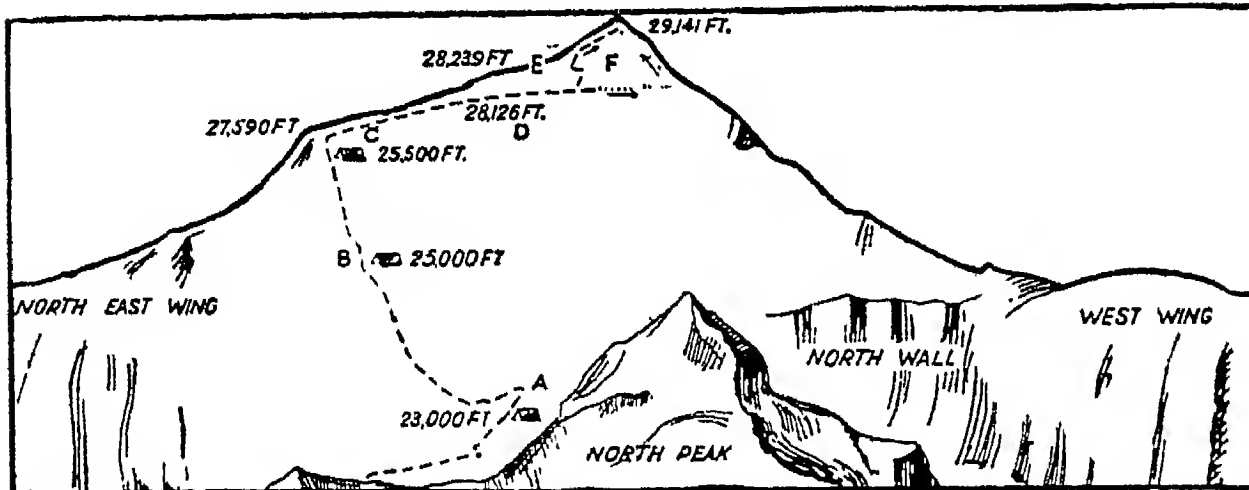
Evening Standard, THE. London evening newspaper, started June 11, 1860, as a pendant to its morning namesake, itself originally an evening paper first published May 21, 1827. Acquired from the Johnstone family in 1905 by C. Arthur Pearson, who had in 1903 purchased the *St. James's Gazette* (founded in 1880), *The Evening Standard* was merged with the latter. In 1910 Davison Dalziel secured the controlling influence; in 1915–23 it was owned by Hulton & Co., and from 1924 by Lord Beaverbrook. Famous regular contributors have included Arnold Bennett, Dr. W. R. Inge, and the cartoonist David Low.

Evenlode. Tributary of the river Thames, in Oxfordshire, England. Rising near Kingham on the Gloucestershire border, it flows generally S.E. to join the main river between Eynsham and Yarnton, 4 m. N.W. of Oxford.

Evensong. Form of worship prescribed by the Prayer Book of the Established Church. First drawn up in 1549 and revised in 1552 and 1662, it consists of responses, psalms, lessons, and collects taken from the services of vespers and compline in the medieval breviary, with additional features such as general confession and absolution, prayers for the sovereign, clergy, people, etc.

Everest. The world's highest mt., variously est. at 29,028; 29,040; 29,141 ft. (official alt. 29,002 ft.). It is in the Himalayas, on the border between Nepal and Tibet; its peak has often been confused with that of its neighbour, Gaurisaukar. Named after Sir George Everest (1790–1866), surveyor general of India, it is covered with snow and difficult of access. Many climbing expeditions tried in vain before the summit was scaled in 1953.

Of the expeditions on foot, those in 1921, 1935, and 1951 were



Everest. Diagram showing at A, B, and C the positions of the three highest camps established by all climbers. D, height reached by Norton and Somerville, June 4th, 1924. E, spot where Mallory and Irvine disappeared, June 8, 1924. F, broken and dotted lines indicate alternative routes to the summit

reconnaissance, and those of 1922, 1924, 1933, 1936, 1938, and 1952 attempts to scale the mountain. Two members of the 1924 expedition, A. C. Irvine and G. L. Mallory, reached 26,800 ft. and then set out alone to climb the remainder of the distance; they disappeared at 28,239 ft. On May 29, 1953, a New Zealander, E. P. Hillary, and a Sherpa, Tensing Bhutia, reached the summit and returned safely. John Hunt, leader of this expedition, and Hillary were knighted, and Tensing was awarded the George Medal, in recognition of their feat. (Consult *The Ascent of Everest*, Sir John Hunt, 1953.) A Swiss expedition, led by A. Eggler, twice ascended Everest in 1956.

EVEREST AIR EXPEDITION. In 1932 Lady Houston financed the Houston-Everest air expedition led by L. V. Stewart Blacker and P. T. Etherton. Two Westland biplanes were fitted out. The base was at Purnea, 260 m. N. of Calcutta.

The first flight was made on April 3, 1933. Everest's characteristic plume (composed of ice particles) indicated a terrific wind, soon found to be about 110 m.p.h., but the summit was surmounted for the first time in history. Thirty-five successful oblique photographs were obtained, but the dust haze ruined all vertical survey photographs. Kinchinjunga was explored next day. A second flight to Everest was made on April 19, when vertical photographs of unexplored territory around the peak led to more accurate mapping.

Everett. City of Massachusetts, U.S.A., in Middlesex co. It

stands on the Mystic river 3 m. N. of Boston, and is served by the Boston and Albany rly. Its industrial activities include ironfoundry, oil refining, and the manufacture of chemicals, paints and varnishes, tools, optical and leather goods. Settled 1630, it was incorporated 1870. Pop. (1950) 45,982.

Everett. City of Washington, U.S.A., the co. seat of Snohomish co. A port of entry on an arm of Puget Sound, it is 30 m. by rly. N. of Seattle. Situated in a mineral, lumbering, agricultural, and fishing region, it has an excellent landlocked harbour and two airports. Settled in 1862, it was incorporated as a village in 1892, and became a city in 1908. Pop. (1950) 33,849.

Everett, EDWARD (1794-1865). American statesman and orator. Born at Dorchester, Mass., April 11, 1794, he was for two years a Unitarian minister. He became professor of Greek at Harvard, 1819-25, and president, 1846-49. He edited the *North American Review*, 1820-24, was member of congress 1824-35, minister to

Great Britain 1841-45, and senator 1853-54, when he abandoned public life. In politics Everett was a Republican, and when the Civil War broke out he strongly supported the cause of the Union, although to the last he had hoped that war might be averted. He died at Boston, Jan. 15, 1865. His reputation chiefly rests upon his lectures and speeches. *Orations and Speeches* were published 1850-59. Consult *Life and Services*, R. H. Dana, 1865; *Life*, P. R. Frothingham, 1925.

Everglades. Swampy wilderness in S. Florida, U.S.A. The region is low-lying and its heavy rainfall and high temperature encourage the rank growth of vegetation, thus increasing the natural difficulty of drainage. Situated mostly in Dade co., it extends N. to S. for about 120 m. and is about 50 m. broad. During the rainy season it has a depth of 1 ft. to 10 ft. It contains a number of islands bearing cypresses, pines, palms, and vines, but is mainly a huge, almost impenetrable, tract covered with saw-grass which reaches a height of 6 ft. Projects undertaken by private firms and state and federal governments, including construction of 450 m. of drainage canals and the 140-m. Cross-Florida Waterway, have effected the reclamation of several million acres. One result is the cultivation of sugar cane, some of which reaches a height of 20 ft.; lemon, orange, and rubber trees also grow here, and lettuce, string beans, and cabbage are cultivated to some extent. The state and university of Florida have established the Everglades experimental station, where the agricultural possibilities of the region are studied. Characteristic features are the palm-thatched huts of the Seminole Indians. See Florida.

Evergreens. Plants whose leaves last several years and are not shed simultaneously. The plants are thus never leafless. The holly, for example, produces new leaves each season, but each of these lives for three or four years; therefore, although there is a leaf-fall every year, it affects only the oldest leaves and the foliage as a whole is always full and green. Evergreen leaves are of leathery consistence with glossy surface, and are thus protected against rapid loss of moisture in summer and the effects of frost in winter.

Everlastings OR IMMORTELLES. Term applied to the flower-heads of certain composite plants. Their bracts are of a hard, parchment-



Everest from Mt. Phalut, Darjeeling. Over five miles high, its summit is the loftiest in the world

like character and coloured, so that if gathered in their prime, *i.e.* just before they are fully expanded, they will retain their form and colour for several years. The most striking of these are species of *Helichrysum*, *Acroclinium*, *Rhodanthe*, *Aphelaxis*, *Waitzia*, and *Xeranthemum*. They should be hung heads downwards to dry.



Everlasting Flowers
of *Helichrysum*
bracteatum

Evershed, SIR FRANCIS RAYMOND EVERSHED, BARON (b.1899). British judge. Born Aug. 8, 1899, he was educated at Clifton and Balliol College, Oxford, and called to the bar in 1923. Chairman of the central price regulation committee, 1939-42; controller of the Notts, Derby, and Leics coal-producing region, 1942-44; chairman of commissions on cotton-spinners' and dockers' wages, and of a committee on supreme court practice, he was knighted 1944, appointed lord justice of appeal, 1947, master of the rolls, 1949, and made a peer 1956.

Eversley. Village and parish of Hampshire, England, 14 m. N.E. of Basingstoke. The church of S. Mary, early 18th cent., had Charles Kingsley for its rector 1844-75. He is buried in the churchyard. Near is Bramshill House, erected for Prince Henry, son of James I.

Eversley, CHARLES SHAW-LEFEVRE, VISCOUNT (1794-1888). British politician. Born Feb. 22, 1794, he was educated at Winchester and Trinity College, Cambridge. He entered parliament as a Whig in 1830 and sat for N. Hants during 1832-57. After



Viscount Eversley,
British politician

serving as chairman of various committees, he was elected Speaker in 1839, and filled that office with distinction during the difficult times of O'Connell and the free trade debates. In 1857 he retired, becoming Viscount Eversley. He died without an heir at Heckfield, Hants, Dec. 28, 1888. A nephew, G. J. Shaw-Lefevre, was created Baron Eversley (*v.i.*).

Eversley, GEORGE JOHN SHAW-LEFEVRE, BARON (1832-1928). British politician. Born June 12, 1832, he was educated at Eton and Trinity College, Cambridge. As a Liberal he was M.P. for Reading, 1863-85, and for Bradford, 1885-95. He was civil lord of the admiralty in 1856; secretary to the board of trade, 1869-71; first commissioner of works, 1881-83 and 1892-93; postmaster-general, 1883-84; and president of the local government board, 1894-95. Raised to the peerage in 1906, he died April 19, 1928.

Everton. Parish of Lancashire, England, forming a N.E. suburb of Liverpool, and within its borough limits. Here is S. Edward's Roman Catholic College, founded 1842 and enlarged in 1875. It stands in its own grounds of 11 acres. Everton is celebrated for its toffee and its football club (*v.i.*).

Everton. Association football club. Founded in 1878 in a Methodist chapel, it first played in Stanley Park, Liverpool, on the opposite side of a road from the present enclosure, Goodison Park. Everton was one of the twelve clubs that founded the Football League in 1888, and except in the season 1930-31 has always played in the first division. It won the League championship in 1891, 1915, 1928, 1932, and 1939; and the F.A. Cup in 1906 and 1933. It has the unique record of gaining in three successive seasons (1930-33) the championships of the second division and first division, and a Cup victory.

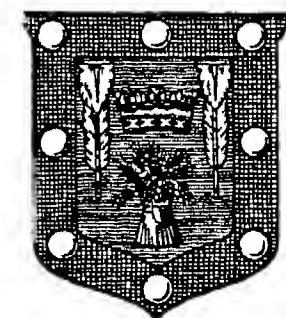
Everyman. English morality play of the late 15th century, probably translated from its Dutch counterpart, *Elckerlijck* (printed c. 1495). The earliest known editions of *Everyman* were printed by Richard Pynson (undated, but apparently before 1531). The play, which "comprises the whole pitiful pathos of human life and death," is one of the finest examples of the moralities. The story of God's summoning of *Everyman* (all mankind represented as an individual) by Death on that journey which none may escape, and of *Everyman's* attempts to find a willing companion, is based on an earlier parable told in the religious romance of Barlaam and Josaphat (*q.v.*). A choreographic version by Mona Inglesby, with music from the tone poems of Richard Strauss, was performed by the International Ballet in 1943.

Everyman's Library. Name of a series of reissues of classics in ancient and modern literature of

every kind. This venture was started by John Mallaby Dent (1849-1926) in 1906 and published by the firm bearing his name. Ernest Rhys was long the general editor. Each volume was given a preface by a leading authority. By 1956 the library included 1,000 works; and more than 42,000,000 copies had been sold.

Everyman Theatre. Theatre at Hampstead, London, N.W.3. A drill-hall close to the tube station was acquired and fitted up as a small theatre with a seating capacity of about 300. This was opened on Sept. 15, 1920, with *Bonds of Interest*, a Spanish comedy by Jacinto Benevente, and other plays notable for their intellectual appeal followed. The theatre later became a cinema at which films of special interest were revived.

Evesham. Mun. bor. and market town of Worcestershire, England. It stands on the Avon, 15 m.



Evesham arms

E.S.E. of Worcester, and is served by two railway lines. S. Egwin founded a Benedictine monastery here in the 8th century, of which a bell tower, of fine ornate Perpendicular, and gateway still remain. The town hall is an Elizabethan structure, and the grammar school was founded by Abbot Lichfield in 1536. The battle of Evesham was fought at Green Hill; its site is marked by an obelisk. Fruit growing and market gardening are engaged in and the asparagus beds are famous. There is excellent boating on the



Evesham. Bell tower, survival of the 8th cent. Benedictine monastery

Avon. Market day, Mon. Until 1950 the town gave its name to a co. div. with one M.P. Pop. (1951) 12,066. About 2½ m. N.W. is Wood Norton, once the residence of French dukes, and a home of the B.B.C. early in the Second Great War. The famous and fertile Vale of Evesham is much visited in the season of fruit blossom.

Evesham, BATTLE OF. Fought Aug. 4, 1265, between the royalists under Edward, afterwards Edward I, and the baronial party under Simon de Montfort. Defections had broken Montfort's power, and in the summer of 1265 he was retreating before his foes. The force which his son Simon was bringing from the S. to join him was destroyed by Edward at Kenilworth, Aug. 1, and the elder Simon, falling back into Wales, halted at Evesham, Aug. 3. Prince Edward hastened up and cut off all chances of escape. His plans were so cleverly laid that Earl Simon exclaimed: "God have mercy on our souls, for our bodies are theirs." The royalists attacked in two divisions, and the battle was soon over. Numbers told; both Simon's horse and foot gave way, the former only after a stubborn resistance, and Montfort and his son Henry were killed.

Eviction (Lat. *evincere*, to overcome). Name given to the process of ejecting a tenant from a house or land. Since the First Great War severe limitations have been imposed on the right of landlords to evict tenants of houses within the Rent Restrictions Acts. See Distraint; Ireland: History.

Evidence (Lat. *evidentia*). Word used for the legal method of proving facts in a court of law. The law of evidence is one of the chief points of difference in the administration of justice between English-speaking countries and others. English courts are very strict in their admission of evidence, or rather in their exclusion of certain matters of evidence and modes of proof. The chief rules of evidence are: (1) All evidence must be relevant to the issue; (2) such relevant matters must be proved by the "best" evidence.

Relevancy is really a matter of logic. How far any given fact offered to be proved tends to prove any matter in issue is for the judge to decide. One or two things may be borne in mind. A witness's opinion (e.g. "I think the driver of the car was to blame") is no evidence. It is never relevant, except where technical matters are in dispute, and then the opinion of

skilled experts is admitted because there is no other way of arriving at the facts. The character of the parties is not relevant; if I sue a man for damages for fraud I am not allowed to call 50 witnesses to show that he is a man who has committed other frauds. All I am allowed to do is to cross-examine him as to his character, and try to drive him to admit that his record is bad. But even this is not evidence that he defrauded me.

The only time a plaintiff, or prosecutor, can call evidence of the kind above described is where the evidence shows a system of wrongdoing, and the act in issue is a part of the system—long term frauds for example. On the other hand, a man accused of crime may always bring evidence of his good character. Even in libel it is not permissible to prove misconduct by the plaintiff so as to show he has a bad character unless the defendant has justified the libel—although evidence of generally bad reputation may be given.

The rule of best evidence is a rule of exclusion. It excludes hearsay. If you wish to prove something seen or heard, you must put in the box the man who saw or heard it, and not (with certain exceptions) a man who heard that another man saw or heard it. The contents of a document must be proved by producing the document itself. If the document is, or has been, in the possession of the other side, which does not produce it after notice to do so, secondary evidence may be given. Again, if the judge is satisfied that it has been lost, stolen, or destroyed, secondary evidence is admissible. Bankers are allowed, instead of producing their books in court, to send a certified copy. There are whole classes of public documents, such as entries in marriage, birth, and death registers, wills, or bills of sale, which can be proved by officially certified copies.

These rules remain in full force for all criminal proceedings, but in civil proceedings some relaxations were introduced by the Evidence Act, 1938. Where direct evidence of a person by word of mouth would be admissible, any statement made by him in a document may be used if either he had personal knowledge of the facts or, where the document is part of a continuous record—e.g. an account book—he made entries or other statements as part of his duty and obtained the facts from someone who might reasonably be supposed to know them. The

maker of the statement must generally be called. The court may, however, admit a copy of the document containing the statement instead of the original. Statements cannot be used if made by an interested person at a time when proceedings were either pending or were anticipated.

There are long established exceptions to the hearsay rule applying to statements either oral or in writing. In pedigree cases, statements by a deceased member of the family—e.g. in a Bible—made before the litigation may be used. In all cases, declarations against interest, e.g. by a deceased person, may be admitted. In trials for homicide, declarations by the person killed are admissible to prove the circumstances of death, provided he knew that he was dying. See Jurisprudence; Law.

Evidences of Christianity, A VIEW OF THE. Theological work by William Paley first published in 1794, containing (1) the direct historical evidences of Christianity; (2) the auxiliary evidences; and (3) a consideration of some popular objections. Largely based on Butler's Analogy of Religion and Nathaniel Lardner's Credibility of the Gospel History, the work, in its time hailed as a crushing reply to scepticism, has come to be regarded as inadequate.

Evil. In the theological and ethical sense the absence of good, or unsatisfied desire. Neither definition is satisfactory. To say that evil is the absence or the opposite of good at once raises the question, "What is good?" and the answer must depend largely upon the standpoint of the individual. To define evil as unsatisfied desire pre-supposes that the desire itself is not evil. If it is, its frustration is good rather than evil. To find the supreme good in the satisfaction of desire, and evil in its frustration, ignores the possibility of a higher and external moral imperative taking precedence over mere personal desire.

From the theological point of view, the definition of evil is comparatively simple. It is that which does not conform to the Will of God. But the Will of God is manifested by both direct command and by permission. Evil, like all other things, can only exist by divine permission; and in this sense its existence is not contrary to the Will of God. But the thing in itself and the fact of its existence are not the same thing. The Will of God may permit the existence of an evil which is itself directly

opposed to that Will; and such permission in no sense makes God the author or the cause of evil.

Why evil is permitted to exist has always been a perplexing problem; and it is not greatly helped by the counter question: "Does evil exist?" If evil is a mere negation or absence of good, it has no real existence, and is nothing at all. What really happens is that the good exists in a less degree than is to be desired. The existence of so-called evil, therefore, resolves itself into this—that the universe is not perfect. Viewing evil as merely imperfection, the problem of its existence becomes less difficult. It is no reflection on the goodness of God that He is pleased to let the world progress through imperfection to perfection.

Another element in the problem of evil is that of relativity. In certain circumstances and in some relations a thing may be evil which is not necessarily evil in itself. But we are not in a position to judge the circumstances or to weigh the relations; for the simple reason that only a portion of the world of reality lies within our ken. We see only part of the machine; and those parts which appear inappropriate or superfluous may be essential or beneficial to the part of which we know nothing. See Ethics.

Evil Eye. Faculty of causing material harm by means of a glance. In Shakespeare, and in modern rural England, it is called overlooking. From its ancient Roman name *fascinum* comes the word fascination. Distinguishable from the subjective influence of the eyes of snakes, it denotes a form of witchcraft, owing its origin to the presumption that the eye is capable of operating at a distance. It may be exerted, voluntarily or involuntarily, upon human beings and domestic animals, especially when young, besides crops, dwellings, and other objects. Envy (Lat. *invidia*, on-looking) is a potent incentive of evil eye.

The belief is traceable to the beginnings of recorded history, and its widespread survival in primitive culture attests its primeval origin. Various curative and preventive measures are employed. Prevention is sought by spitting, muttering counter-charms, making offensive figures or gestures, giving to children opprobrious names, wearing knotted cords, or displaying amulets, many of which are specific for evil eye. They include representations of eyes, hands, horns, teeth, shells, nuts, lunar

crescents, red and blue objects, and magical or sacred texts. Evil eye is referred to by its technical name in Gal. 3, where it is translated "bewitched." The Greek belief is enshrined in the mythical gorgon Medusa, whose glance turned its victims to stone; the use of the gorgon's head as an amulet persists in doorknockers. See Divination; Magic.

Evil-Merodach (d. 560 B.C.). Biblical version of the name of Amel-Marduk, king of Babylon 562–560 B.C. He was the son of Nebuchadnezzar II, and according to Berossus his short reign was lawless and violent; he was murdered in a rebellion raised by his brother-in-law Neriglissar (the Nergalsharezer of Jer. 39).

Evocator. Any substance which, when applied to eggs in the early stages of their development, evokes responses leading to the production of recognizably differentiated tissues, or organs.

Many evocators are known chemical substances and have much in common with hormones (*q.v.*). See Embryology.

Evolute (Lat. *e*, from, out. *volvere*, to roll). In geometry a curve which is the path of all points that are the centres of curvature of a second curve called the involute. To measure the curvature of any involute we find a circle which coincides with the curve for a short distance. If the curvature to be measured is great this circle of curvature can only have a small radius because it will accompany the first curve only a small way. If the curvature is small the radius of the circle will be correspondingly larger. The centre of this circle at any point on the curve is the centre of curvature at that point. It is clear that there will be a number of these circles for any curve. When their centres are all joined up they form the evolute. See Circle; Geometry.

EVOLUTION: THE SHAPING OF LIFE-FORMS

*Paul G. 'Espinasse and J. Arthur Thompson, LL.D.

This important article can well be supplemented by those on Anthropology; Biology; Life; Man; Sex. See also Cell; Heredity, etc.; and Darwin; Galton, and biographies of other biologists

Evolution (Lat. *evolvere*, to unroll) is a process wherein one kind of living creature gives rise to another kind, which persists alongside of or in place of the original stock. Thus we believe that birds evolved from an ancient reptilian stock, and mankind from a primitive simian lineage, the origins in both cases being extinct. In the case of domestic pigeons derived from the wild rock-dove (*Columba livia*), or of poultry derived from the jungle-fowl (*Gallus bankiva*), the origins are still extant. Similarly, wild ancestors of such cultivated plants as cabbages and apple-trees still exist. The evolutionary process is going on among wild plants and animals, *e.g.* in some evening primroses, or in many birds and butterflies, but is not often easily detected in a lifetime or in the relatively short time since precise biological registration began.

While evolution is strictly a slow racial change in living creatures, the term is often used much more widely. Evolution should not be confused with development, which is best restricted to a continuous change in one and the same unity, such as a germ, a seed, an organ, an institution, or a solar system. Development agrees with evolution in being a series of changes in a definite direction from one position of equilibrium

to another, but differs from it in concerning one and the same individual system from beginning to end, whereas evolution is racial, implying a succession of generations and a sifting process. Briefly, development in biology is the individual's coming to be (Ontogeny); evolution, in biology, is the genetic history of a race (Phylogeny). Hence we should speak of the development, not of the evolution, of the earth.

Evolution may be in the direction of increased complexity and control (differentiation and integration), or in the opposite direction. A tapeworm is the result of a process of evolution just as surely as is the golden eagle within which it lives. Yet in spite of many instances of retrogressive evolution in animate nature, the general trend of the process has been progressive, *i.e.* towards increased differentiation and integration of fuller and freer life. This fact must never be lost sight of in contemplating the history of things as a whole.

As applied to living creatures, the evolution theory states the broad idea that the present is the child of the past and the parent of the future. The fauna and flora of today, both in themselves and in their myriad inter-relations, are the outcome of an antecedent state

of affairs in which animals and plants were on the whole rather simpler. This again originated in organisms and relations simpler still, and so on back through hundreds of millions of years, until all clues are lost, and we find ourselves in the mist of life's beginnings. The evolution theory thus states the view that the manifold intricacy of animate nature has arisen by a natural process of slow organic change, similar to that seen in the history of domestic animals and cultivated plants.

One point remains to be emphasized. The statement that living creatures have come to be as they are by evolution, only means that their history has been a natural history, the moves in which have known, or at any rate knowable, causes. To think that any result whatsoever acquires dignity, permanency, worth, invulnerability, or sanctity, because it is the result of evolution, is a misunderstanding, for the value of survival, as judged by human standards, depends on the conditions under which survival is secured.

Evidences of Organic Evolution

This general evolution theory, or doctrine of descent, is the only scientific way of answering the question: How has the present-day system of animate nature come into being? But while many facts of zoology and botany serve as evidences of evolution, four main lines of argument have been followed by Darwin and others.

The first is mainly anatomical. Many facts in regard to structure corroborate the evolutionist interpretation, and seem to naturalists to admit of no other. Thus, the fore-limb of a frog, the paddle of a turtle, the wing of a bird, the fore-leg of a horse, the flipper of a whale, the wing of a bat, the arm of a man, exhibit in diverse guise the same essential parts, twisted into manifold forms for different uses, but always of the same fundamental type. There is essential similarity in the important bones, and considerable resemblance in the musculature, innervation, and blood-supply. All these fore-limbs are homologous with one another, *i.e.* they agree in fundamental structure and development. It is difficult to understand this adherence to type except on the theory of the actual flesh-and-blood relationship of backboned animals. Many vestigial organs in animals, especially the higher animals, remain very slightly developed and are of no use; comparable, as Darwin said,

to unpronounced letters in words, the *o* in leopard, or the *b* in doubt. Man has a minute useless third eyelid and a hint of muscles for moving the trumpet of the ear. The only rational interpretation of such structures is the evolutionist one, that they are dwindling relics of structures well developed and of some functional importance in ancestral forms.

The Physiological Argument

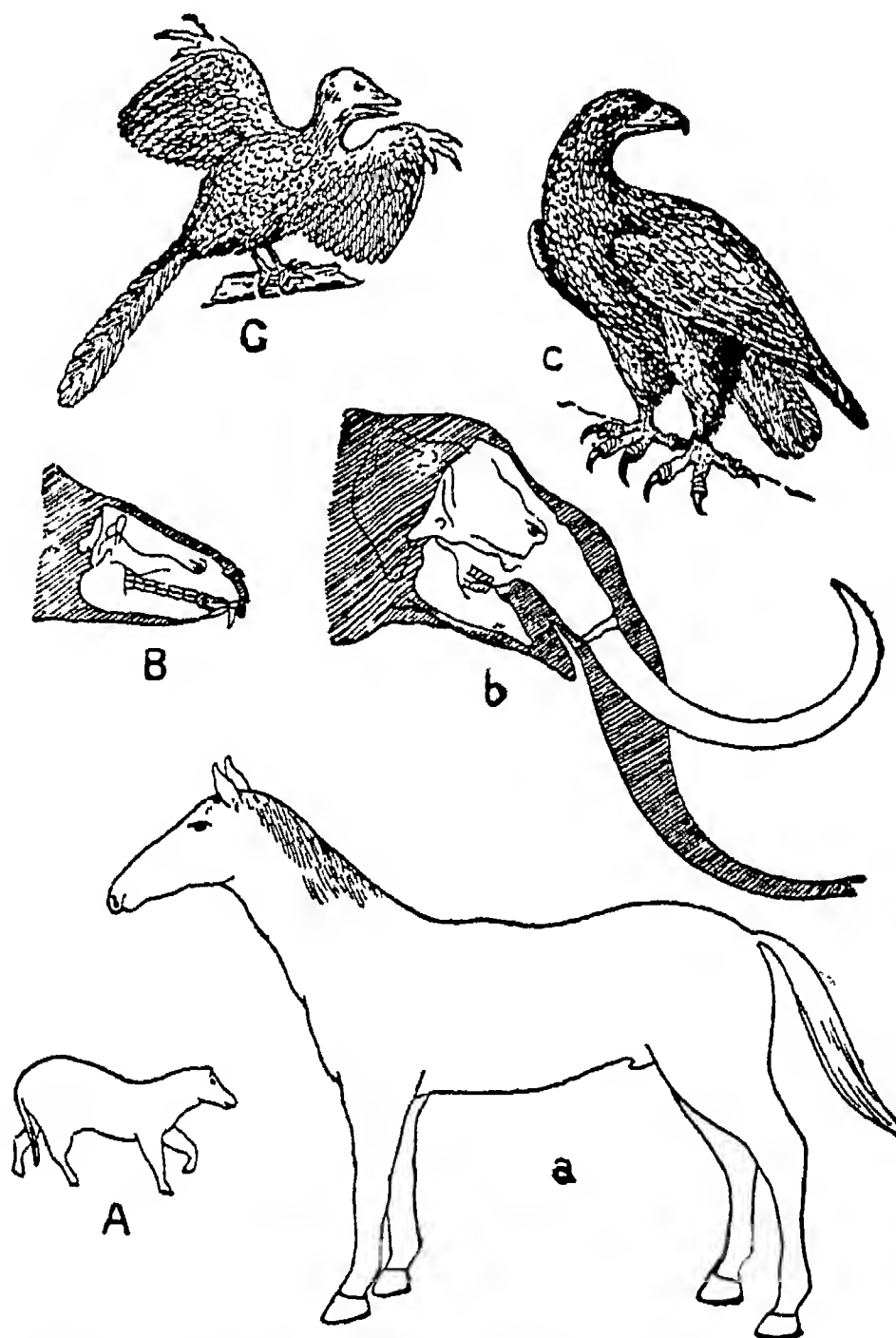
The second line of argument may be called physiological. When the blood of, for instance, a horse is injected into, say, a rabbit, the rabbit makes an "anti-horse" substance which will violently and immediately attack horse blood. It will not attack the blood of a bird, but it will attack to some extent the blood of an ass. This means that an ass has blood more like that of a horse than is the blood of a bird. By modification of this experiment it is possible to gauge the degree of relationship between man and the various groups of apes and monkeys. Along with this physiological argument may be taken the abundant

evidence of the variability of living creatures. In a short time man has established over 200 breeds of domestic pigeons, which seem all to have been derived from the blue rock-dove.

Another line of argument is historical or palaeontological. From the rock record we have accumulated a great mass of material in regard to the successive appearance of horse-types, elephant-types, crocodile-types, and so forth, all reading like a lineage or pedigree. Moreover, there are many connecting links now extinct, such as *Archaeopteryx* (*see* Birds), which, though an indubitable bird, has several well-marked reptilian features, *e.g.* teeth in both jaws, a lizard-like tail, and claws on the three digits of the hand. Again, there is the big fact that in the rock record amphibians appear after fishes, reptiles after amphibians, birds and mammals after reptiles; as age succeeded age, nobler and nobler forms of life emerged.

The embryological evidence is very striking. The embryos of the higher vertebrates, *viz.* reptiles, birds, and mammals, develop for a considerable distance along the same road, or along closely parallel roads, before they diverge. For instance, in the neck region of the embryo higher vertebrate, there are gill-clefts or visceral clefts which have no respiratory significance, and can hardly be said to be useful, except that the first becomes the Eustachian tube connecting the ear passage with the back of the mouth. These can only be recapitulations of some of the embryonic stages of the respiratory apparatus of remote aquatic, lower vertebrate ancestors.

There was a time when the temperature of the earth was far too high to admit of the existence of



Evolution. Early and late stages in evolution. A. Early four-toed ancestor of the horse. Its proportionate size is shown by comparison with a. B. Head and skull of an early ancestor (*Meritherium*) of the elephant, whose head and skull are shown in b. C. The oldest known bird, *Archaeopteryx*, two specimens of which have been obtained from Jurassic strata, compared with c, golden eagle

By courtesy of Alex. Melrose

any forms of life like those we know. Whether germs of living organisms reached the earth from elsewhere, or whether very simple living organisms evolved upon the earth out of non-living matter, is unknown, but it is certain that living organisms did have a beginning upon the earth, and probable that the first organisms resembled in some respects present day viruses. Some of these may have given rise to the bacterial type of organism, consisting of a minute globule of chromatin surrounded by an organized envelope. As time went on and size increased, the chromatin-globules might increase in number and acquire some complexity of arrangement, and a non-chromatinic ground substance (cytoplasm) might become organized around them to provide a special immediate environment or fairly elaborate envelope.

Prototype of the Animal

A predatory organism may have arisen by the formation, around a number of chromatin-grains, of such an enveloping matrix of semi-fluid substance capable of enwrapping and digesting living particles. This was a prototype of the animal, and it preyed upon other minute creatures. Later on, the chromatin-grains congregated to form a definite cell-nucleus in the midst of the active matrix, and a true animal was formed. These suggestions serve to indicate that in all probability a long journey had to be travelled before even the first true animals or plants made their appearance.

The next great steps probably consisted in the establishment of numerous distinct types of cellular organization. On the animal line of evolution, towards which the primeval amoeboid organisms pointed, there doubtless arose all sorts of specialisations of the creeping form, many with supporting skeletal framework. More active forms had lashes of protoplasm instead of outflowing threads and lobes. Others, with an enclosing cyst, were adapted for spending much of their life passively waiting for suitable conditions, or as parasites.

One of the primeval great events must have been the emergence of green plants. These perhaps originated among flagellate infusorians on the animal line which had been able to build up the green pigment chlorophyll, the most important substance in the world, next to living matter itself. The divergence between plants and animals was one of the greatest cleavages in

evolution. While all typical animals require organic food which has been worked up for them by other living creatures, green plants are able to utilise the energy of the sunlight in their chlorophyll machinery to manufacture from the carbon dioxide of the air complex organic compounds. Thus green plants feed at a low chemical level, on air, water, and salts, and build up nutritive materials which animals utilise.

Moreover, the plant is almost always surrounded by an envelope or cell-wall of cellulose, and this restriction, taken along with the poorly developed means of getting rid of nitrogenous waste-products, may explain the tendency to fixity shown by plant-life. We are unable here to follow the evolution of the plant world which went on simultaneously with that of the animal world. One of the striking general impressions is that of a succession of dominant groups, each reaching supremacy, and then yielding to another. Thus the gigantic club-mosses and horse-tails which made great forests yielded to Cycad-like forms and thereafter passed into relative insignificance; while the Cycadophytes in their turn yielded to the flowering plants.

First Multicellular Organisms

It was a red-letter day in organic evolution when "bodies" began to be, *i.e.* when some living creatures passed possibly to the multicellular grade of organization. Many flagellate infusorians form colonies or families of connected cells, the daughter-units formed by division of the mother-unit, remaining associated, instead of drifting apart to live isolated lives, and it was probably in some such way that multicellular organisms began. It must be clearly understood that the step was not primarily one of increase in size, for a rotifer or wheel-animalcule built up of a thousand cells is much smaller than a unicellular infusorian such as *Noctiluca* (*q.v.*).

Nor was the step primarily one of increasing complexity either of organization or of activity, for many ciliated infusorians, though acellular, are far more complex in plasmic architecture and in ways of life than the fresh-water polyps, divided into thousands of cells. The step was on to a new line of organization, the formation of a many-celled body in which scope was given to division of labour among the component units. The structural side of this is called differentiation. The at-

tainment of a multicellular body opened the way to unlimited specialisation of function, and, partly because of the increased efficiency of execution thus attained also to an increase of size, which, other things being equal, counts for something in a rough and callous physical environment. The nemesis of this great step of gaining a body was apparently that organisms became liable to natural death in proportion to the complexity of the bodily framework. For natural death appears to result from the accumulation of wear and tear effects, and the failure of the ceaseless attempts to cope with these.

Evolution of Sex

Another big step was the evolution of male and female multicellular individuals within the same species, the two sexes being complementary in the process of reproduction which secures the continuance of the race. The biological significance of the evolution of sex among multicellular animals is that it offered opportunities for new permutations and combinations of qualities, for those new departures technically called variations and mutations. The separation of sperm-producers or males and egg-producers or females, which differ deeply in constitution, would also tend to increase the range of cross-fertilisation which is often advantageous, and would permit of a profitable division of labour between the parents in their relations to the offspring.

Differentiation includes a multitude of evolutionary steps. In the creature called *Volvox*, which consists of a thousand or ten thousand flagellate green cells united in a ball, all the component units, except those concerned with reproduction, are alike. There is little or no division of labour in the colony. In sponges, however, we see the beginnings of tissues, *i.e.* groups of similar cells performing the same functions. Thus contractile tissue, connective tissue, and flagellate lining tissue (or epithelium) appear among sponges. In the next great series of animals, the Coelenterata, other kinds of tissue, such as nervous and glandular, are differentiated, and in them we find the first occurrence of organs, such as the sensory, the digestive, and the reproductive organs.

In most sponges and Coelenterata, the symmetry of the body is radial, *i.e.* there is no right or left side; the animal is the same all round. This is well suited to a sedentary or drifting existence, but

for more strenuous life involving the pursuit of prey and mates, and the avoidance of enemies, bilateral symmetry, which virtually began among "worms," is incomparably more effective. It implies a right and a left side, a head end which leads the way, and a tail end.

With the acquisition of bilateral symmetry was associated the establishment of an anterior brain and the development of a head worthy of the name. This opened up another line of advance, technically called integration, in contrast to differentiation. Differentiation means increasing complexity of parts, integration means their more perfect unification and control; and one of the main functions of the nervous system is integrative.

Progressive Differentiation

The story of evolution, apart from retrogressive parasites and other degenerates, is one of progressive differentiation and complementary integration, and the evolutionist has to record a long series of achievements, *e.g.* an open food canal; a body cavity or coelom between the food canal and the body wall; striped or swiftly contracting muscle; a circulatory system for distributing digested food and oxygen throughout the body and for collecting waste; oxygen-capturing pigments such as haemoglobin; a segmented body as in earthworms; a renewable external armour as in crustaceans; muscular appendages first unjointed and then jointed; specialised sense organs such as eyes and balancers, improved respiratory arrangements reaching, within their limits, extraordinary perfection among insects; delicate adjustments for filtering out the poisonous nitrogenous waste of the body.

We can only allude to the establishment of the leading type of architecture represented by the various series of invertebrates or backboneless animals. Besides the sponges and Coelenterata, we have to deal with the great variety of worm-types; with the higher segmented worms or annelids; with the starfishes, sea-urchins, and the like forming the echinoderms; with the jointed-footed arthropods, such as crustaceans, insects, and spiders; with the unsegmented molluscs without appendages, such as bivalves, snails, and cuttles; and with many smaller groups.

A step of great magnitude was the origin of the backboned animals or vertebrates. It is not unlikely that these emerged from the stock of sea-squirts or tunicates. Their origin meant a fresh start on

a new line of more masterful life. A dominant feature was the establishment of a relatively large brain protected by a skull, and of a long, spinal cord protected by the backbone. Of great importance also was the first appearance of bone and of an internal living skeleton (usually of bone) pervading the whole body, and contributing to integration. In the establishment of numerous glands of internal secretion, whose hormones or regulative substances are distributed by the blood throughout the body, a chemical integration began to operate, or to do so on a larger scale and more rapidly.

Skulls began with the hags and lampreys; jaws and paired fins, scales and typical gills, with the true fishes; digits, true lungs, vocal chords, and a mobile tongue with amphibians; the antenatal robes (or foetal membranes) known as amnion and allantois with the reptiles. A four-chambered heart happened twice: once in the ordinary reptiles such as the crocodilians; and once quite differently and independently in another group of reptiles which, before becoming extinct, gave rise to the mammals; warm-bloodedness, or keeping the temperature of the body approximately constant, began independently in birds and mammals, which also show an enormous advance in brain development; the usually prolonged antenatal connexion between mother and offspring is carried furthest in the placental mammals.

Instinct and Intelligence Compared

Along with the great structural advances, there went a functional progressiveness. The smooth working that marks even the simplest creatures is not lost with intricate organization; but the scope of the life is widened and its agency becomes more free. In a sense, the behaviour of a ciliated infusorian is just as perfect as that of a bird, but the range is narrower, and the resources are fewer. The behaviour of ants and bees is extraordinarily effective on the instinctive line (*see* Instinct), and in its way unsurpassable. It cannot be profitably pitted against the behaviour of a horse or a dog, which is on the intelligent line, for its range resources are narrower. The instinctive creature is apt to be sadly non-plussed by some slight alteration in the routine of its experience. What Sir Ray Lankester has called the "little-brain" type, rich in inborn or instinctive capacities but slow to learn, must be distinguished from the "big-brain" with little

ready-made equipment, but with prodigious educability.

The big-brain type came to its own in birds and mammals, and there convincing evidence is found of an inner mental life of experimenting, *i.e.* intelligence. Interesting also is the fact that, as an organism attains to complex efficiency and to more or less intelligent mastery of its environment, it is able to practise reproductive economy. There are fewer offspring, but there is less mortality.

Emergence of the Human Race

In the Early Eocene age, millions of years ago, there emerged an arboreal race, the Primates, differentiated from other mammals in digits, teeth, skull, and brain. From this stock there diverged in succession the New and Old World monkeys, the small anthropoid apes (gibbon and siamang), and the large anthropoid apes (orang, chimpanzee, and gorilla). This left towards the end of the Oligocene (or perhaps in the Miocene) a generalised human stem, from which there diverged in succession Pithecanthropus the erect, the slouching man of Neanderthal, and the early Briton of the Sussex Weald—known by the famous Piltdown skull. None of the offshoots came to much, it seems, but the main stem continued as the stock of modern man, pieced together in relatively recent times into African, Australian, Mongolian, and European races.

With the emergence of man evolution passed on to another grade. For there are several reasons for avoiding the false simplicity of regarding social evolution as no more than a continuation of infra-human evolution. The first and chief reason is to be found in man's undeniable apartness and pre-eminence as a rational and social person. Man is differentiated by his language, by his capacity for forming and experimenting with general ideas, *i.e.* by his reason, by his vivid self-consciousness of his own evolution and by purposeful determination to control it; and by his strong kin-instincts. The second reason is the fact that in social history we have to deal with integrates of social persons, operating as unities of a higher order. The third reason is the importance of what lies outside the individual, namely, in literature and art, the folk-ways of customs and tradition, the external registrations which we call institutions. New notes are struck, and the evolution of man, though continuous with, is more than a mere continuation

of, the evolution that goes on in infra-human animate nature.

While the general idea of evolution is accepted by most naturalists, there is great uncertainty in regard to the operative factors. The uncertainty is partly due to the difficulty of arguing from a meagre experience of the present to a past of many millions of years, and partly to the fact that the inquiry is still very young, for it virtually dates from Darwin's *Origin of Species*, 1859.

There are two main problems. The first asks how the continual emergence of new things, of changes or variations which make an organism appreciably different from its parents or its kin, is to be accounted for. The second asks what directive factors may operate on the variations which arise, determining their elimination or persistence and working towards the familiar but puzzling result—the existence of distinct and relatively well-adapted species.

Some of the peculiarities or observed differences distinguishing members of the same species can be shown to be individually acquired bodily modifications directly due to some peculiarity of nurture in the widest sense. But as there is no secure evidence that these characteristics are transmitted to the offspring, they can be only of indirect importance to the race. The raw material of evolution is furnished not by these modifications, but by variations which are inborn—variations of what are called genes.

Fluctuations and Mutations

Among variations in structure resulting from the interaction of these variant genes with the environment, there may be distinguished minute peculiarities, and larger abrupt sports of notable amount, such as a fantail pigeon or a copper beech. The former, Darwin's "individual variations," may be usefully termed fluctuations. The sports correspond to Galton's "transient variations," Bateson's "discontinuous variations," De Vries's "mutations," and the last term should be kept for them. The transmissibility of inborn fluctuations has been proved in a few cases, and it was Darwin's conviction that "it is by the accumulation of such extremely slight variations that new species arise."

As to the origin of those minute novelties, a falling out of some feature, or a rearrangement of certain characters displayed by ancestors, it is possible to think of

them as due to the intricate permutations and combinations that occur in the history of the germinal material in the germ-cells, especially during maturation and fertilisation.

But the baffling problem is the origin of the distinctively new, where the novelty seems qualitative, not quantitative, where a new pattern, like a genius, appears. At present science cannot go beyond tentative suggestions. Many facts suggest that some environmental influences, in particular certain radiations, may act as variational stimuli on the germ-cells and provoke mutation. It is also known that one species may differ from another in the number, shape, size, and structure of its nuclear bodies or chromosomes, and just as bacteria sometimes change suddenly in their physiological properties, so the chromosomes which last on from generation to generation may change in their stereochemic architecture or functional powers.

Factor of Natural Selection

The most clearly discerned directive factor in organic evolution is natural selection, the process by which, in the struggle for existence, certain variants of a species, marked from their fellows by the presence or absence of some character, are on that account favoured with longer life or more successful families than their neighbours, who are therefore sooner or later eliminated. The full title of Darwin's great work should be remembered: *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*. He stated the gist of the theory, which Wallace had independently reached, in a couple of sentences: "As many more individuals of each species are born than can possibly survive, and as, consequently, there is frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life will have a better chance of surviving, and thus be naturally selected. From the strong principle of inheritance any selected variety will tend to propagate its new and modified form."

There are several different modes of natural selection; thus it is useful to distinguish between "lethal selection," which works by the discriminate elimination of the relatively less fit, and "reproductive selection," which works

through the increased multiplication of the relatively more fit. The operation of natural selection has been satisfactorily demonstrated in a few cases, and it is certainly a potent directive factor. To turn to a less difficult point, it is important to avoid the popular fallacy that natural selection works out the survival of the fittest in any absolute sense; what ensues is the survival of the relatively more fit to the given conditions—and this may not always imply desirability.

Yet the idea should be emphasised that natural selection operates in part in reference to a system of inter-relations which is continually becoming more complex, which is made up of many stable and beautiful and intelligent components that have stood the test of time. Therefore, natural selection does not work capriciously; we get at least a hint of the reason for its working on the whole progressively. Besides selection, some have recognized isolation as a directive factor; that is to say, all the barriers which restrict the range of intercrossing within a species. "I do not doubt," Darwin said, "that isolation is of considerable importance in the formation of new species."

Steady Development of Mental Processes

When we look back on the majestic process by which the present system of animate nature has come to be, certain general impressions arise in the mind. In the course of the ages there has been, in the animal world, a progressive evolution of the nervous system, an increasing elaboration of behaviour, a gradual increase of free agency, a growing emancipation of mentality. Since the beginning of life there has been on the part of living creatures an increasing appreciation and mastery of their world. To man, who is part and parcel of Nature, though also singularly apart from it, there is encouragement in the fact that we know of no reason for believing that the evolutionary process will stop.

Another highly important general impression of great interest is that while organisms are ever experimenting and tentative, proving all things, they are just as characteristically given to holding fast to that which is good. Species become extinct and races perish, but great organic inventions, such as amoeboid movement or haemoglobin or hormones, are carried on by some collateral lineage. There

is a strong power of conservation in the midst of the evolutionary flux.

As Lotze said, the process of evolution has the unity of an onward advancing melody. Retrogressions and involutions there have been and are, but the big fact is progress to finer issues. With the growing differentiation and integration (*i.e.* complexity and control) in organisms, there was correlated some degree of external registration in the system of inter-relations gradually established. For one result of organic evolution has been the weaving of a web of life whose pattern has become more and more intricate, as in the inter-relations between flowers and their insect visitors. The complexifying of relations has probably been of great importance in evolution, for it is in reference to this external system that new organic experiments are tested and that selection works. Thus it seems that the intensification of life has been in part secured and in part prompted by the growing complexity of the external system of nature.

Thus living creatures contribute to the evolution of their kind, not only directly by exhibiting variations and by personally testing these, but also indirectly by contributing to the complexifying of the external web of life. If this be so, there is for man the hint that progressive evolution depends not merely on the improvement of the natural inheritance and intensification of the individual life, but also on the ennoblement of the external heritage—so much man's own creation—the treasures of literature and art, the tradition of high ideals, and the multitudinous linkages, many in need of amelioration, in the framework of society.

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Evora. District of Portugal, in the province of Alemtejo. It is bounded on the N. by the dist. of Portalegre and on the S. by the dist. of Beja. The river Guadiana forms its E. boundary. Hilly on the N.W. and S., it slopes E. and S., forming the basin of the Degebe and smaller streams flowing into the Guadiana. A large portion of the district is barren, but there are

cork-oak forests. The capital is Evora; Montemor and Reguengos are other towns. Pop. 221,700.

Evora (anc. Eborac). City and archiepiscopal see of Portugal, capital of Evora dist. Beautifully situated on a low hill in a fertile plain, 72 m. by rly. E. of Lisbon, it is enclosed by ancient walls and towers, and has a Roman temple, other Roman and Moorish remains, a cathedral, founded in 1186, a 16th century church, an art gallery, and a famous aqueduct built c. 1550. It manufactures cloth, cotton and woollen goods, and hats, and trades in wine. In the vicinity are copper and iron mines, and marble and asbestos quarries. An important fair is held annually. A town of some importance in the Roman province of Lusitania, Evora was a bishop's see under the Visigoths, taken by the Moors in 715, and recaptured by the Christians in 1166. Pop. 28,000.

Évreux. City of Normandy, France. It is 67 m. W.N.W. of Paris, and stands on the Iton, a branch of the Eure, in the dept. of Eure, of which it is the capital. The earliest part of the cathedral of Notre Dame dated from the 11th century and some part from the 16th. It was completely restored at the end of the 19th. Other old buildings were the church of S. Taurin, a Romanesque building of the 11th century, to which an abbey was at one time attached, the episcopal palace, and the belfry. The hôtel de ville, museum, public library, and botanical gardens were notable. There are some small manufactures and a considerable agricultural trade.

Évreux was frequently besieged and taken in the wars between England and France. At Vieil Évreux, 4 m. distant, extensive remains of a Roman theatre, baths, aqueduct, etc., have been unearthed. In the Middle Ages, the counts of Évreux were powerful nobles; the dignity was given in 1427 to Sir John Stuart of Darnley, a Scot in the French service. The English family of Devereux takes its name from here. In the Second Great War, on June 13, 1940, Évreux was bombed by the Germans, who occupied it shortly afterwards. U.S. troops liberated the town on Aug. 23, 1944. Pop. 20,436.

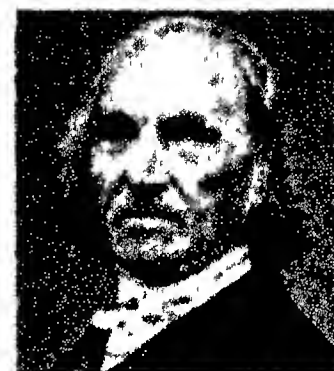
Evros. Greek name of the river of the Balkans described under its Bulgarian name Maritsa.

Evzones or EUZONES. Greek troops. They bear a variant of the name given to troops in the times of ancient Greece, Euzonoi, mean-

ing well-girdled, and so girt up for fighting. They are light troops consisting normally of about six battalions, and from their dress are known as the Greek Highlanders. Their uniform consists of a white kilt or *fustanella*, wide-sleeved white shirt, embroidered vest, red-pointed shoes, and blue-tasselled red cap. The Evzones fought in Macedonia and Serbia in the First Great War, and in the Second distinguished themselves against the Italians in Albania and against the Germans in Greece.

Ewald, CARL (1856–1908). Danish novelist. Born in Slesvig, when a child he removed with his family to Copenhagen after the annexation of the duchy by Germany. He started in active work as a forester, but turned to novel writing, in which he won distinction. In *The Old Room* he depicted a rebel against orthodox life, and in *Cordt's Son* his opposite in a strict observer of the conventions. Several of his stories have been translated into English by Teixeira de Mattos, notably *Two-Legs and Other Stories*, 1907; *My Little Boy*, 1908; and *The Pond and Other Stories*, 1909. *Pron.* Ayvahl.

Ewald, GEORG HEINRICH AUGUST VON (1803–75). German Biblical critic and Orientalist. He was born Nov. 16, 1803, at Göttingen, where



Heinrich Ewald,
German scholar

in 1831 he became professor of Oriental languages and philosophy. In 1838 he was appointed to the chair of Theology at Tübingen, and in 1848 returned to Göttingen,

where in 1867 his retirement came about through political complications. His numerous works include a *Hebrew Grammar*, 1827, but the most important was his *Geschichte des Volkes Israel*, 1843–59. His criticism was cautious, and he exposed the extreme views of the Tübingen school. He died May 4, 1875. *Pron.* Ayvalt.

Ewald or EVALD, JOHANNES (1743–81). A Danish poet, born Nov. 18, 1743, at Copenhagen. Yearning for change and adventure, while still a student at Copenhagen university he joined the army of Frederick the Great, then engaged in the Seven Years War, but later deserted to the Austrians. In 1760 he returned to Denmark and resumed his studies. A cantata written in 1766 on the death of Frederick V of Denmark

placed him in the front rank of lyric poets; but his drama, *Balder's Death* (1773), in which he introduced the old gods of Scandinavian mythology, first ensured his fame and gave an immense stimulus to the national pride in the legendary past of Denmark. George Borrow's English translation of this was published in 1889. Other well-known works are *Adam and Eve*, 1769, and *The Fisherman*, 1778. Ewald died March 17, 1781. His *Collected Works*, ed. H. Brix and V. Kuhr, appeared in 1941.

Ewbank, THOMAS (1792-1870). British author. Born at Barnard Castle, March 11, 1792, at the age of 13 he was apprenticed to a plumber, and in 1812 obtained employment in London as a labourer. He emigrated to America about 1819, and started a metal tube manufactory in New York, from which business he retired in 1836. After travelling in Brazil, 1845-46, he published his *Life in Brazil*, 1856. Ewbank was commissioner of patents 1849-52. The remainder of his life was largely spent in writing on engineering subjects. He died in New York, Sept. 16, 1870.

Ewé. Cluster of African dialects in the Kwa language group (Sudarni). They are spoken by the Negro peoples of Dahomé, southern Togoland, and south-eastern Ghana (Gold Coast). The groups using them numbered some 686,000 in 1948. Ewé speakers form a collection of culturally fairly homogeneous sub-tribes; a movement towards political unification originated in 1945 with a few educated Ewé.

Ewell. Village of Kent, England, 3 m. N.W. of Dover. Here King John met the papal legate Pandulf in 1213, subsequently making at Dover complete submission to the pope.

Another Ewell forms part of the borough of Epsom (*q.v.*).

Ewell, RICHARD STODDERT (1817-72). American soldier. Born at Georgetown and educated at West Point, he fought against the Mexicans and Indians, but on the outbreak of the Civil War resigned his commission to fight for the Confederacy, and took part in both battles of Bull Run, Antietam, Chancellorsville, Gettysburg, and others. In the closing days of the war, on April 6, 1865, Ewell and his force were captured by Sheridan at Sailor's Creek. He died at Springfield, Tenn., Jan. 25, 1872.

Ewer. Pitcher or jug with a wide mouth. It is used particularly for holding water for toilet

purposes. The word is a corruption of Lat. *aquarium*, watering place; cf. Fr. *eau*, water. See *Damascening illus.*

Ewing, ALFRED CYRIL (b. 1899). British philosopher. Educated at University College, Oxford, he was assistant lecturer in philosophy at Swansea university, 1927-31, and was then appointed lecturer in moral science at Cambridge. His publications included *Kant's Treatment of Causality*, 1924; *The Morality of Punishment*, 1929; *Idealism*, 1934; *Reason and Intuition*, 1941.

Ewing, SIR JAMES ALFRED (1855-1935). British physicist and engineer. Born at Dundee, March 27, 1855, he was educated at the high school and at Edinburgh university. Until 1878 he assisted Lord Kelvin, and during 1878-83 was professor of mechanical engineering at the Imperial university of Tokyo, where he studied earthquakes. During 1883-90 Ewing was professor of engineering at University College, Dundee; and of mechanism and applied mechanics at Cambridge, 1890-1903. He became a member of the ordnance research board in 1906, having been since 1903 director of naval education. In 1916 he became principal and vice-chancellor of Edinburgh university, resigning 1929. Among his important inventions were: magnetic curve-tracer, hysteresis tester, and a permeability bridge, all used in testing the iron employed in making dynamos and transformers. He was knighted in 1911, and died Jan. 7, 1935.

Ewing, JULIANA HORATIA (1841-85). British writer of stories for children. She was the daughter



Juliana H. Ewing,
British author

of Alfred Gatty, vicar of Ecclesfield, Yorks, and the wife of Major Alexander Ewing. Among the pleasantest of her tales are *The Land of Lost Toys*, 1869; *A Flat Iron for a Farthing*, 1873; *Jackanapes*, 1884; and *The Story of a Short Life*, 1885. She died May 13, 1885.

Ewins, ARTHUR JAMES (b. 1882). British chemist. Born Feb. 3, 1882, he was educated at Alleyn's school and London university. In 1899 he entered the Wellcome physiological laboratories as assistant. Research chemist in 1917 to May and Baker,

Ltd., he later became director of research, and in 1932 discovered with Dr. M. Phillips the drug M. and B. 693.

Examination. Method of discovering the qualifications in certain stated respects of persons submitting to it. Examinations may be designed to test personal qualities or knowledge or skill or understanding. In some form they are, and will probably always be, an important part of the procedure of social selection. In 20th century education, examinations of a more or less formal character affect considerably the type of school the individual attends, the type of instruction he receives there, the record with which he leaves school, his eligibility for various forms of further education, his right to follow a particular occupation, his success in applications for employment, or his eligibility for promotion. One of the commonest forms of examination is the competitive interview. It is also one of the most difficult to systematise and to make objective and reliable as a means of measurement.

Practical men throughout the ages have in their own way assessed the qualities and suitability of prospective employees. Formal methods of examination developed first at the universities, in order to judge the relative attainments of scholars and their fitness to teach and later to practise one of the learned professions. But as the title "senior wrangler" (Cambridge university) indicates, the examination originally took the form of disputation, the candidate having publicly to answer questions and to argue and maintain a thesis against the cross-questions of the examiners. Subsequently, questions were dictated to supplement the oral questions and answers, but there is no record of any written examination questions in Europe earlier than the 18th century. In the 20th printed question papers are in many cases supplemented by oral, or *viva voce*, examinations. More often, however, the examination is conducted wholly by printed question papers, and the candidate's written answers are the only link between the examiner and the candidate, the sole data by which the examiner judges. This fact has given rise to widespread criticism of the examination system.

It is argued:

(a) That a candidate's performance in such an examination is dependent too much on his

physical condition at the time, particularly his nervous condition, and on his command of words; further, on the accident of the examiner's choice of questions, which cannot exhaustively test an elaborate syllabus:

(b) That in any case the examination shows only whether the candidate knew certain things at a certain time, and does not reveal whether or not the knowledge or the skill manifested is permanent;

(c) That examination syllabuses encourage teachers to become "crammers" and to concentrate rather on imparting facts that may be useful in the examination room than on developing the pupil's capacity to use his mother-wit; and that, in particular, in the grammar schools of the country the requirements of examination syllabuses dominate the work of the school and stunt the wider mental and aesthetic development of the pupils;

(d) That the normal examination paper cannot provide an objective measurement of the candidate's performance, the marks awarded being to a large extent a reflection of the idiosyncrasies of the examiner.

Many committees have considered and reported on the examination system, and proposed, for example:

(a) That the results of written examinations should be only supplementary to the student's educational record;

(b) That examination papers should consist of a great number of short questions (say 100 or more), each of which can be answered correctly in only one way, so that the examiner's predilections have no scope and the whole syllabus of study can be covered by the questions set;

(c) That an examination for a general certificate of education should be taken by all secondary school pupils as a leaving examination, and that only students proceeding to a university should sit for the university entrance or matriculation examination. (Circular 168 of the ministry of Education implemented these recommendations made in 1947 by the secondary schools examinations council.)

In 1931 an international inquiry into examinations was organized under the auspices of the Carnegie foundation and the International Institute of Teachers' college, Columbia university. Separate committees investigated examinations in England, France, Germany, Scotland, Switzerland,

and the U.S.A. The English committee published in 1936 a short report, *An Examination of Examinations*. This showed clearly that a large element of chance entered into the results of some important types of examination, such as the school certificate examinations, taken by more than 60,000 pupils annually; the entrance examinations by which about 400,000 children were transferred from the elementary to the secondary school at 10 to 12 years; university college scholarship examinations, and university honours examinations; further, that the conventional type of written examination was by no means a rigid yard-stick; and that methods of examining could be improved. Little change of method developed, however.

Attempts have been made to evolve a technique of examining that would reveal and measure the quality and distinctive characteristics of a person's intelligence and personality, and thus indicate his potentialities and his special aptitudes rather than his current attainments in certain directions. Such methods were used during the Second Great War to classify recruits to the U.S. and British forces, and particularly to select men and women for commissions. The U.K. War Office Selection Board (W.O.S.B.) methods were adopted by some of the larger business houses in the selection of their personnel, particularly those intended for senior executive posts. The National Institute of Industrial Psychology, London, was closely associated with this development.

Intelligence tests, aiming at an assessment of an individual's educability, are a common method of classifying pupils. Tests of mechanical aptitude are often imposed on junior applicants for employment to discover, before they begin training, whether they are likely to develop reasonable skill in special clerical or industrial processes.

See Civil Service; Education; Intelligence Test; Profession; Psychology; School; University. Consult *An English Bibliography of Examinations*, 1934; *An Examination of Examinations*, 1936; *Essays on Examinations*, 1936 (all published under the auspices of the International Institute Examination Enquiry); *Aptitudes and Aptitude Testing*, W. V. Bingham, 1937; *Handbook of Commercial and Technical Education*, ed. H. Downs, 1939.

Examiner of Plays. British official created in 1737, when the lord chamberlain became responsible for the licensing of plays and appointed an examiner to act as his reader. The statutory authority rests with the lord chamberlain; the examiner has no legal existence. Nevertheless, by the end of the 19th century the examiner had become, in effect, a dictator in the theatre. His opposition to the intellectual revival towards the close of the 19th and at the opening of the 20th century, his banning of plays by Ibsen, Maeterlinck, and Shaw, resulted in the appointment of a select committee of both houses of parliament to consider the question of dramatic censorship. As a result of their report reforms were carried out, the duties of an examiner being henceforth restricted to reading, reporting, and advising on the plays submitted for licence.

Exarch (Gr. *exarchos*, leader). In Byzantine history, a title specially applied to the military governor of the district of Ravenna in Italy. The exarch has been compared to the viceroy of India. The direct representative of the emperor, he commanded the troops, controlled the civil administration and finance, and influenced ecclesiastical affairs. The exarchate of Ravenna lasted 584-752.

There was also an exarch of Africa, the earliest mention of whom occurs in 591. The name exarch was also given to a dignitary of the church who held a position below that of the patriarch, but above that of the metropolitan, and to the head of certain monasteries, and survives as the title of the patriarch of Bulgaria.

Excalibur. King Arthur's magic sword; called Caliburn and made in the isle of Avalon. In the *Morte d'Arthur* the king takes the sword from the hand of the Lady of the Lake, and learns that its name signifies Cut-Steel, and that while he has the scabbard he can never be sore wounded and cannot lose blood. When stricken down in the final battle, Arthur commands that the sword be thrown into the lake, where it is caught by a hand and vanishes. See *Morte d'Arthur*.

Excambion. Term used in Scots law for an exchange of lands. The law allows this to be done in the case of entailed property, as well as unentailed, several statutes to this effect having been passed. It is often done to make boundaries and other divisions of property more convenient.

Excavator. Machine for the removal of soil. Except in small jobs or where confined quarters render mechanical excavation impracticable, excavation is done by various types of machine. It is a preliminary operation to building, and involves clearing the site, digging out the foundations, digging trenches for drains, etc. Excavation is also carried out in mining and quarrying: in open-cast mining for coal, for example, the "overburden" (overlying soil) is stripped from the coal deposit by the shovel or drag-line. In quarries, sand pits, and gravel pits and brickworks, the material is dug out with the shovel; the same machine is used for road and railway construction, and the excavation of tunnels. In general the shovel is the appliance for excavation work above ground level.

The shovel comprises the base machinery, with boom, dipper-stick or sticks, and dipper. The last, which is the digging or shovelling member, is attached to the dipper-stick and has a flap bottom door retained by a latch; the door is released to dump the load. Upward and downward movements of the dipper and handle are controlled by the hoist-rope and brake.

The drag-line is used for digging below the ground level on which the machine stands, and operates even if water be present in the workings. Hence its employment for canal and drainage work. There is a wide range of sizes, with capacities of from $\frac{1}{4}$ cu. yd. to 20 cu. yds., and with boom lengths of 25-225 ft. The boom is usually of lattice steel construction, a bucket being suspended from it by a hoisting rope. A drag-rope passes through a fairlead on the front of the revolving superstructure and is attached to the drag-line bucket.

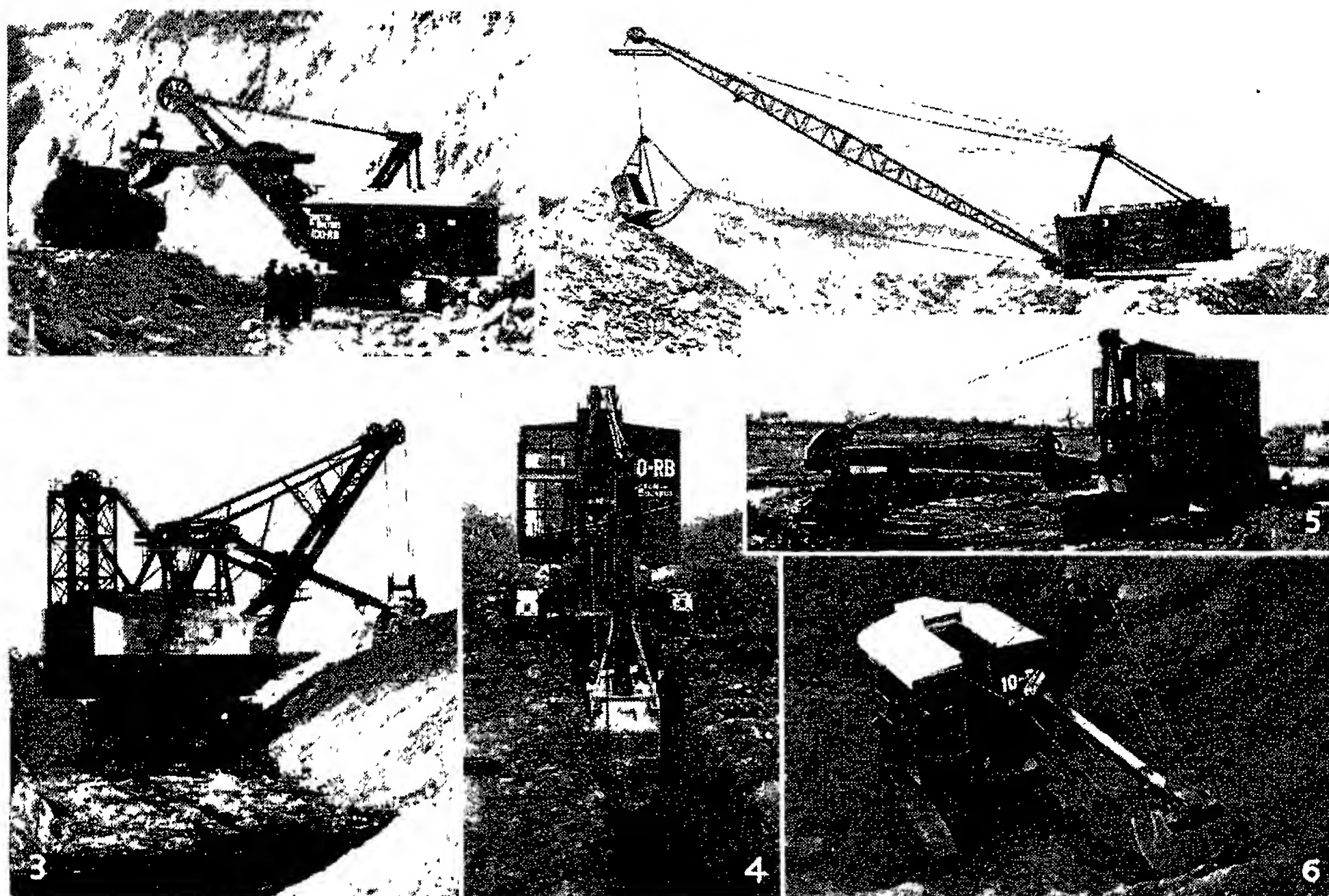
The machine's digging action is obtained by lowering the bucket towards the base of the excavator until it rests on the ground, and pulling it by means of the drag-rope. Teeth on the bottom of the front part of the bucket penetrate and scoop the soil during this action. The load in the bucket is tipped by slacking off the drag-rope; a tipping rope assists this operation.

Where the soil is too heavy to be dug effectively by a drag-line, a drag-shovel is used; it is used also for digging below ground level when the excavation is not too deep. Particularly suitable for trenching work, it has the qualification of the drag-line with

the advantage of the shovel, the dipper being held rigidly to its cut. In principle the machine is a shovel in reverse, except that the dipper-stick is pivoted to the top of the boom, and the dipper is fastened to the end of the stick facing back towards the machine. The drag-shovel can excavate trenches to 25 ft. Skimmers and drag-shovels often have a common boom.

The skimmer takes shallow cuts from the surface. It consists of a box-section boom along which the skimmer-bucket slides in a horizontal direction away from the machine. Its use is limited to shallow excavating. The prising action of the bucket teeth breaks up ground, and the machine can also load the material. During digging, the boom is kept horizontal or at the grade desired, and the bucket is pulled along the boom until full. Then the boom is lifted and rotated to the dumping position required, where the load is discharged by unlatching the pivoted bottom of the bucket. The radius of action is as much as 30 ft. without moving the machine.

The grabbing crane or clamshell is mainly used for handling loose material, though sometimes for excavation. Universal machines



Excavator : appliances used in different situations. 1. Electrically driven 4 cu. yd. quarry shovel. 2. Walking drag-line, much used in canal and drainage work. 3. Thirty-three cu. yd. shovel, one of the largest types of excavator. 4. Drag-shovel excavating a deep trench. 5. Skimmer engaged on levelling work. 6. Half-yard shovel on creeper track

are excavators (generally not exceeding 1 cu. yard in capacity) which have a common base machine, usually powered by a Diesel engine, and various types of digging equipment. They can readily be converted to shovel, drag-line, drag-shovel, skimmer, grabbing crane, or lifting crane.

The name front-end equipment describes the digging attachment fitted to the base machine to perform various kinds of work. The base machine generally comprises a friction-clutch-operated superstructure with two rope drums, powered by a Diesel engine, petrol engine, or electric motor. Means are provided to rotate the superstructure on the travelling base. Base machines are usually caterpillar-mounted and are extremely mobile.

SOIL MOVING AND TRANSPORTING. Soil dug out by excavating machines must usually be removed by ancillary equipment such as dumpers and trucks. In surface work such as road making or the levelling of an area for an airfield, much of the actual trimming and contouring is done by bulldozers, scrapers, and graders. Once the surface soil is loosened by scarifiers which rip up the earth, the latter can be pushed along bodily by a bulldozer: this is a scoop-like shovel fixed at the front of a Diesel-engined tractor-like vehicle, usually on caterpillar track. The soil fills the blade or bowl and the material in front is pushed along as the bulldozer advances. The bulldozer can also push soil to one side of a road being constructed; in an angledozer, the blade is set at an angle to the line of travel of the vehicle, and so thrusts the soil to one side. Soft soil can be dug by these appliances.

The scraper removes soil as it traverses the area. Some forms load the soil into a receptacle as they go; others, like the bulldozer, push some material ahead, and carry more soil in the scoop or pan. The grader is used to form slopes or to shape the crown of a road, etc. In one type the soil moved by the blade is carried to the belt of an elevator forming part of the machine, and is discharged at the side, clear of the roadway, canal bed, etc. Dumpers (*q.v.*) receive material from the excavating shovel or other digging appliance and carry it to the unloading point.

PUMPING, ETC. Excavation in permeable ground, where heavy inflows of water are expected, requires special methods. An in-

dependent system of pumping to depress the level of the groundwater is often installed; cylinders and cofferdams are constructed by sheet piling. Compressed air is used in tunnel excavation and where the hydrostatic head does not exceed 100 ft. Other methods include grouting processes whereby the injection of chemicals or cement has the effect of solidifying the ground whilst excavation is in progress. An alternative to compressed air, particularly in shaft sinking is the freezing process, whereby chilled brine is circulated through small tubes lowered into boreholes surrounding the site, and so gradually forms an impermeable membrane in the shape of an ice wall. This process, however, is expensive, and, moreover, a long period elapses before the soil is frozen.

Excellency. Title of honour, formerly applied to emperors, kings, princes, and other high personages. In modern British usage it is confined to the governors of dominions, colonies, and Northern Ireland, to ambassadors, envoys, and, from 1948, Commonwealth high commissioners. In France and the S. American republics the president is styled Excellency; in Continental countries the title is often applied to cabinet ministers. In Italy, the form *eccellenza* is often used in addressing strangers.

Excellent, H.M.S. Chief school of gunnery for the Royal Navy. It is situated on Whale Island, Portsmouth. Whale Island is largely artificial, having been built up from earth excavated during the construction of Portsmouth dockyard. Officers and men are trained as specialists in all branches of naval artillery.

EXCHANGE: BASIS OF FOREIGN TRADE

F. A. Willman, Expert in Banking and Currency

This article describes the essential functions of foreign exchange in international trade, both when free and when under government control. See also Economics; International Monetary Fund; Money; etc.

Exchange (Lat. *ex*, out; late Lat. *cambiare*, to change) comprises transactions of international finance. Since nations maintain different currencies, every transaction of international trade or finance involves the changing of the purchaser's currency into that of the seller. Thus, if an Englishman buys wheat from Canada, and employs a Canadian lawyer to advise him on some point of law connected with the deal, his pounds must be exchanged into Canadian dollars to pay the farmer for his wheat and the lawyer for his services, since pounds

Excelsior. Lyric poem by H. W. Longfellow, published in *Ballads and Other Poems*, 1841. It is intended to show the life of a man symbolised in an Alpine climber, resisting all temptations, laying aside fears, heedless of warnings, and pressing right on to accomplish his purpose. After every warning, in the face of every temptation, he repeats *Excelsior*, higher; and then perishes without having reached the perfection he longed for. The voice heard in the air at the close promises immortality and progress ever upward.

Excess Profits Tax. Tax introduced by the British government as a war measure in 1939. It was then levied at 60 p.c., but was raised in May, 1940, to 100 p.c. of profits earned by a commercial undertaking in excess of those of a pre-war standard period. The National Defence Contribution was an alternative, the taxpayer being liable for whichever was higher. Between 1940 and the end of the war in 1945, E.P.T. realized over £1,600 millions. The tax was lowered in Dec., 1945, to 60 p.c., and at the end of 1946 it was repealed. In certain cases rebates of 20 p.c. were made to firms wishing to expand their business.

In Sept., 1915, an Excess Profits Duty was imposed by the British government to help meet the cost of the First Great War. Profits in excess of the average made in the years 1912-1914 were dutiable at the rate of 50 p.c., raised to 60 p.c. in 1916 and 80 p.c. in 1918. Duty was not charged on the first £200 of excess profits, and farmers and professional men were exempt. The duty was abolished in March, 1921. See *Taxation*.

are not the currency of Canada. Similarly, if an Englishman receives money from France, the French francs must be changed into pounds before they can be spent in England.

In practice, one currency is exchanged into another by banks, assisted by brokers. Thus, the purchaser of Canadian wheat draws a cheque on his bank in pounds, but the bank pays the Canadian exporter in dollars. To collect a debt due from a Danish importer, an English exporter hands his bank a bill of exchange against which the bank—through

its agent, also a bank, in Copenhagen—collects kroner, which are converted through the banks into pounds.

Exchanges of this kind are possible because banks in every civilized country maintain accounts with banks abroad, such accounts being reckoned in the currency of the country in which they are held. Thus, from its dollar account in Montreal the English bank pays for Canadian wheat, and to its kroner account in Copenhagen the Danish kroner are credited. Banks are, then, both “buyers” and “sellers” of foreign currencies of all kinds, and this side of their business effects the transfer of funds from one country to another and the exchange of the currencies involved. Many thousands of such transactions are conducted daily, and the relationship of one currency to another varies with the trade position of the countries involved.

Method of Publishing Exchange Rates

Exchange rates are published daily in the principal newspapers. In Great Britain some (*e.g.* dollars, francs, kroner) are given as so many units of the foreign currency to £1 sterling, others (*e.g.* the Indian rupee and the Chinese dollar) as so many pence, or shillings and pence, to one foreign unit. The only reason for this is custom. Rates may vary from one day to another. The dollar rate, for instance, may be 2·80½ (two dollars eighty and a half cents) one day and 2·81 the next. Again, rates vary according to the time factor. To pay a Canadian exporter by cabled instructions, a bank may quote 2·67 (two dollars sixty-seven cents) to £1, which will be the telegraphic transfer (or T.T.) rate, while to pay by post it might quote 2·67½, the mail transfer (or M.T.) rate, ruling at the time of the particular transaction.

Exchange rates between countries using the same nominal currency unit are also given; for example, Great Britain, Australia, New Zealand, and S. Africa all use the pound. In these cases the quotation is usually given as the number of Australian (or New Zealand or S. African) pounds which will be paid in Australia (or New Zealand or S. Africa) for £100 paid in in London.

Just as the settlement of debts arising from goods sent from one country to another and services rendered by citizens of one country to citizens of another causes a demand for foreign exchange, so do a variety of financial opera-

tions, such as the making of loans and the payment of interest on them, travellers' expenditure abroad, the investment of funds through a foreign stock exchange. Severe changes in the internal price level of a country, by discouraging or stimulating foreign trade, affect the exchange value of its currency; while a government can arbitrarily raise or lower the value of its currency in relation to that of other countries.

The ideal is a stable exchange rate, for changes involve adjustments in price of imports and exports. Frequent changes discourage trade, since manufacturers and other business men can plan ahead with confidence only when they can be sure that exchange rates will remain stable, or very nearly so. Severe and frequent changes in the value in terms of other currencies of the currency unit for a country with considerable international trade leads to world-wide economic chaos.

Before 1914 many nations adhered to the gold standard, under which their currency had a fixed value in terms of gold. There were no restrictions on the export and import of gold, and when a banker was short of any particular foreign exchange he shipped gold abroad, in coins or bars, receiving in exchange its fixed value in the foreign currency he needed. The English gold sovereign contained 20s. worth of gold; the gold in a French louis d'or and an American eagle was equal to the face value of the coin, and so on; one gold sovereign was always worth 4·866 American gold dollars, and the value of the American dollar in London could not move much below that figure, less the cost of shipping and insuring the metal.

Breakdown of Gold Standard System

The First Great War broke many delicate international mechanisms, among them the gold standard system of exchange. Gold ceased to be in general use as coin except in some gold-producing countries (*e.g.* S. Africa and the U.S.A., which did not go off the gold standard until 1933). This would not have mattered in itself, since gold is almost as much a token of value as is a pound note or a dollar bill, and the value attached to it is almost as arbitrary; but political upheavals, economic disasters, war destruction, and a general lack of appreciation of the need for stability of exchange led to a period of uncertainty in international financial transactions,

precipitated into chaos by the deliberate devaluation of their own currency by some governments, notably that of the mark by the Germans (to evade payment of reparations).

In an attempt to recreate stability, Great Britain in 1925 returned to the gold standard (though she did not again mint gold coins for her own use); but other countries did not, in many cases could not, follow suit, and she went off gold once more in 1931. The British government then set up an exchange equalisation fund with which the Bank of England “bought” or “sold” foreign currencies abroad when market conditions would otherwise have caused severe exchange rate changes. Other governments adopted a similar expedient.

Controlling Exchange Rates

Schemes instituted abroad for the control of foreign exchange dealings in an endeavour to offset the effects of the world depression of the 1930s included clearing agreements, special accounts, and other bi-lateral arrangements which sought to canalise the foreign exchange arising from transactions between two or more countries, and thus to facilitate particular trade relations. Elsewhere, while trade transactions were permitted to pass through the normal exchange channels, those of a capital nature, such as the sale of foreign capital assets, were “blocked,” *i.e.* were forcibly retained in the country in which the assets were sold. Even agreements for direct barter were made to reduce the demand upon the available foreign currency.

When the Second Great War began, Great Britain was obliged to concentrate her industry on production for war needs, and was unable to produce anything approaching the quantity of goods she normally sold abroad. In consequence, the supply of new foreign currency becoming due to her was limited, and she introduced strict control of foreign exchange in order to conserve what capital assets she had and what she could earn, particularly in the form of American dollars, for purchases essential to the prosecution of war, thus preventing them being spent on inessentials. Except for dealings within what was termed the sterling area, an area consisting, broadly, of the British Empire (except Canada and Newfoundland) and mandated territories, plus certain countries which for trade or political reasons, elected

to base the value of their currency on the value of the £1 sterling instead of on the dollar, all dealings involving expenditure in foreign currency were subject to licence; while all foreign currency earned by exports or services, accruing from the sale of foreign investments or in any other way, had to be offered to the Bank of England, for which, both as regards expenditure and collection, the ordinary banks acted as agents. This system not only ensured the best use in the national interests of available foreign currency; it also enabled the Bank of England to fix and enforce agreed rates of exchange.

Desire to secure stable rates of exchange led to the Bretton Woods (*q.v.*) agreement, 1944, which, however, permitted changes in basic rates in given conditions, and in 1949 the U.K. reduced the official rate of exchange of the £ sterling from 4.02 to 2.80 U.S. dollars, a devaluation followed by many other countries.

Exchange. Building wherein brokers, merchants, and bankers meet for the transaction of business. Those whose business it is to buy and sell stocks and shares meet at the stock exchange; the principal market place for rubber in London is referred to as the rubber exchange; metals were, until the Second Great War, dealt in at the London metal exchange; while Lloyds remains the principal exchange in the world for the transaction of shipping insurance. Occasionally, as in the Baltic Exchange, the business dealt in is determined by the geographical distribution of the interests involved rather than being confined to a particular commodity. Most English market towns have a corn exchange which is the meeting place of farmers and those who either buy crops or supply such of their needs as fertilisers, seed, and feeding stuffs. See Stock Exchange.

Exchange. Legal term for the exchange of one piece of land for another by mutual arrangement; or, in ecclesiastical law, the exchange of one living for another by the respective incumbents. The former transaction must be signified by a deed of exchange.

Exchange Equalisation Fund. Instituted by the British Government in 1932. Adherence to the gold standard provided foreign exchange dealers with an alternative, at a fixed price, to their normal purchasing or selling of foreign currencies, and thereby restricted

the fluctuations in the rates, or prices, of these currencies. Abandonment of the gold standard left a country with the choice of artificially restricting dealings in its currency, as by requiring all purchases and sales to pass through a central bank on the terms which that bank decides, or providing a fund by means of which operations could be conducted officially in the ordinary market to offset fluctuations arising from abnormal changes in supply and demand. The same fund could be used also to influence rates of exchange in accordance with current government economic policy.

Those were the purposes of the British Exchange Equalisation Fund which was set up to control the foreign value of sterling after the gold standard was abandoned in 1931. Its assets consisted of sterling funds, gold, and foreign currencies; in 1933 they totalled £375 millions. Within four years the authorised limit of the fund was raised to £575 millions to meet the demand upon its services, and on the outbreak of the Second Great War all limitation was removed. To existing assets there was then added some £263 millions of gold hitherto held by the Bank of England for note cover, and thereafter until the introduction of Lease-Lend (*q.v.*) the fund was used mainly as a means of purchasing abroad munitions of war.

Exchequer. Name given in England to the department entrusted with the duty of receiving the royal revenues. The word means a chess board because it was by means of a device of this kind that the early accounts were kept. The late Lat. equivalent is *scaccarium*, and the *Dialogus de Scaccario*, a treatise of the time of Henry II, gives most of our existing information about the early exchequer. The sittings were held at Winchester and then at Westminster.

The early kings had both a treasury and an exchequer, and the functions of the two have been somewhat intermingled even until the present day. The *Dialogue* tells how the exchequer met, the justiciar, treasurer, chancellor, and other high officials with their clerks attending its meetings, how the receipts were entered on rolls, and how tallies were used in this connexion. It met twice a year, at Easter and Michaelmas, and its main dealings were with the sheriffs who attended to account for the royal revenues which they had collected or failed to collect. In

addition to this court there was a lower exchequer, which was a permanent department and in practice a branch of the treasury.

Gradually certain changes were introduced. The treasurer took the place of the justiciar as its president, and then these high officials ceased to attend its sittings in person. The seal, hitherto held by the chancellor, was given to a new official, and the chancellor of the exchequer came into being. The chief members were known as barons, and they began to hear cases affecting the revenue, resolving themselves into one of the regular courts of law, the court of exchequer, with a court of appeal, the court of exchequer chamber, which existed from 1357 to 1830.

As the country became richer, the duties of the exchequer grew. It dealt not only with the accounts of the counties, but with others which concerned the royal revenue. The exchequer continued in existence until the 19th century. It collected and paid out the royal income and expenditure, while its five barons, under a chief baron, heard cases as a court of law.

In 1834 great changes were made, the old exchequer being practically abolished, the paymaster-general taking over its duties. A new exchequer was set up, but this was an audit office, and in 1866 the present exchequer and audit department was established. The name exchequer remains in several connexions, exchequer bonds, etc., but the main financial work of the country is done by the treasury, whose actual head, however, is the chancellor of the exchequer, and not the first lord of the treasury. The court of exchequer lasted until the legal reforms of 1876.

Scotland and Ireland had each their exchequer and their court of exchequer on the English model. The union of both kingdoms with England made these separate institutions unnecessary, although the Irish exchequer lasted until 1817, and the Scottish court of exchequer until 1856. See Chancellor of the Exchequer; Treasury.

Exchequer and Audit Department. Government department under the comptroller and auditor-general. His business is to see that all public money is expended in accord with the wishes of parliament. Without his authority no money is paid out of the exchequer. He is also the national auditor, bound to notify any irregularities in his annual report to the house of commons. The office,

established in 1866, took over the duties formerly discharged by the comptroller-general and the commissioners for auditing public accounts. The official can be dismissed only at the request of both houses of parliament. His offices are on Victoria Embankment, London.

Exchequer Bonds. British Government security originally issued in 1853 in the form of promissory notes repayable in three to five years. These bonds constituted a common means of government borrowing until after the First Great War, during which issues were made at 3, 5, and 6 p.c. In 1920 an issue was made at 5½ p.c. In 1944, the exchequer bond was revived as a means of raising money for the Second Great War. The rate of interest was, however, 1½ p.c., and the old promissory note form in favour of the bearer was discarded, so that the issue became a government stock in the same way as, for example, war loan, the lender's name appearing on his certificate and the stock being bought and sold on the stock exchange in the usual way. The issue of 1944 was repayable in 1950, but in that year was converted into 2½ p.c. exchequer stock payable in 1955. In 1946 holders of 2½ p.c. Conversion Loan 1944-49 and 2½ p.c. war bonds 1945-47 were offered the right, in lieu of accepting repayment, of converting them into a like amount of 1½ p.c. exchequer bonds.

Exchequer Grants. Contributions made by the exchequer annually under the Local Government Act, 1929, to county councils and county boroughs for local government expenses. A general exchequer contribution is made to a central fund and the latter is apportioned among the counties and boroughs. The grant was originally intended to compensate local authorities for the loss of rates suffered through the de-rating of agricultural land and of industrial and freight transport hereditaments—*e.g.* rlys.—in 1929.

Excise. Excise duties are taxes levied on goods produced and, more recently, services rendered, within a country; as distinct from customs duties, which are levied on goods imported. Excise duties were first introduced during the Civil War. The tax on services in the form of an entertainment tax came into being during the First Great War. Purchase tax, a form of excise duty, introduced during the Second Great War, subjected a large range of commodities to

a tax at the time of purchase as distinct from the time of manufacture. The purpose of this tax was twofold. It augmented the revenue, and it also discouraged the demand for goods of all kinds and thus freed labour for more urgent war purposes and restricted private spending.

Included in excise duties are those taxes collected by means of licences, such as the licence required to retail tobacco, wines, spirits, and beer, to practise as an auctioneer, employ male servants, own dogs, etc. The principal sources of excise duty have been spirits, beer, matches, mechanical lighters, licences, British wines, table waters, patent medicines, playing cards, entertainments, and commodities subject to purchase tax. The growth of revenue from excise duties is shown as follows: 1913-14, £39½ millions; 1948-49, £733½ millions.

Excise Bill. Measure introduced by Sir Robert Walpole in 1733 for the substitution of an excise instead of a customs duty on wine and tobacco. His object was to lessen smuggling and, by making the ports free, to stimulate a re-export trade. The bill aroused much opposition and was withdrawn.

Exciter. Electric generator or dynamo used for supplying current to excite the field magnets of a larger machine. It is used with certain types of direct current machines where it is not practicable to make them self-exciting: also for all alternators. It may be separately driven, but is usually belted or direct-coupled to its main machine; it may reach sizes of 150-200 kilowatts.

An advantage of providing each machine with its own exciter instead of running a group of machines from one house exciter is that control of the main excitation may be carried out by varying the exciter voltage by a resistance in its field circuit, which will have to deal with a very small amount of power. With a common exciter, the control resistance will have to deal with the main machine field current, and large amounts of heat will be generated and have to be dissipated.

Large alternators are frequently fitted with stabilised exciters, the main exciter having its own field supplied by a smaller one. This arrangement prevents surges of current in the main alternator being reflected in the field system and demagnetising or reversing the exciter.

In cinematography an exciter is a small low voltage electric lamp in the sound head of a cine-projector. The light from the lamp passes through the sound track on the film, the varying light falling upon a light-sensitive cell. The varying current produced by the latter, after amplification, is converted into sound by loud speakers.

Exclusion Bill. Measure introduced into the English parliament in 1679 for the purpose of excluding James, duke of York, from the throne. The country was greatly excited by Titus Oates's story of a Roman Catholic plot, and the bill was introduced, Mary and William of Orange being named to succeed Charles II. To save his brother, Charles dissolved parliament, but the bill was again brought forward in 1680 and passed by a large majority in the house of commons. The lords rejected it; and a proposal to substitute the duke of Monmouth for James led to its abandonment in 1681.

Excommunication (Lat. *ex*, out of; *communis*, common). Term used specifically for the temporary or permanent exclusion of an offending member from the fellowship of the Christian Church. Generally it means exclusion from any organized community. Examples are to be found in the history of the Jews (Lev. 13; Num. 9 and 12; Ezra 10). It existed among Greeks, Romans, and Druids, and has affinity in the tabu of the Polynesian islanders.

The Christian Church claims Scriptural authority for excommunication (Matt. 16 and 18; John 12 and 16; 1 Cor. 5). Imposed first by the community and then by the bishops as a penalty for heresy, immorality, or disobedience, its primary objects were the bringing of the offender to repentance, and the protection of the Church from corrupting influences. In pagan and Christian usage it has been imposed in degrees of varying severity, ranging from admonition to temporary and partial suspension, and, finally, anathema (*q.v.*).

Gregory VII first claimed the right to depose kings by excommunication, and an ecclesiastical authority could place a whole country under an interdict. Papal claims of this nature led to much trouble in Elizabethan England.

In the Roman Catholic Church excommunication is now governed by the code of canon law, 1918. The Anglican view is represented in Hooker's Ecclesiastical Polity and Canons 65 and 68. At one time in England, after a person

had been under excommunication for 40 days he might, on the issue of a certificate of the diocesan authority to the court of chancery, be imprisoned on a writ of *excommunicato capiendo* until he submitted and was absolved, and the sentence carried with it a number of civil disabilities. By an act of George III, 53, c. 127, it was provided that no person excommunicated could be imprisoned for more than six months and that no civil incapacity should be imposed.

By 54 George III, c. 68, a similar law was enacted for Ireland. Civil penalties were abolished in Scotland in 1690. In Great Britain, though disciplinary jurisdiction of the eccles. courts over the laity exists still, it is subject to statute and common law, and excommunication in the old sense is virtually obsolete. In recent times imprisonment has been imposed only in cases of ritualistic disobedience. In the Scottish Presbyterian churches, lesser excommunication is an affair of the kirk session; the greater excommunication is a prerogative of the presbytery.

Modern cases of excommunication were those of Bishop Colenso (*q.v.*), 1863, whose deposition was negatived as invalid by the judicial committee of the privy council in 1865, and of Father George Tyrrell for his criticism of Pius X's encyclical against modernism (*q.v.*) in 1907. Notable excommunications in earlier times were those pronounced by Gregory VII against the emperor Henry IV, 1077; Innocent III against King John of England, 1208-14; Gregory IX against the emperor Frederick II, 1228-45; Julius II against Louis XII of France, 1510; Leo X against Luther, 1521; Paul III against Henry VIII, 1535; and Pius V against Elizabeth, 1570.

Excursion, THE. Blank verse poem by William Wordsworth. Published in 1814, it forms the second part of a projected work in three parts entitled *The Recluse*, conceived as a philosophical poem on Man, Nature, and Society. Wordsworth never wrote the third part, but *The Prelude*, an introduction, and the first book of the first part of *The Recluse* were published posthumously in 1850 and 1888 respectively.

Exe. River of Devon, England. It rises in Somerset on Exmoor and flows right across Devon, mainly S., to the English Channel, which it enters by a navigable estuary 6 m. long. Exeter stands on it, as does Tiverton, while Exmouth is at the mouth of the estuary. Its

length is 55 m. Its chief tributaries are the Barle and other streams that rise on Exmoor. A ship canal, 5 m. long, connects Exeter with Topsham, from which point the river is navigable. There is some trout fishing in the Exe, which flows mainly through wild and beautiful scenery.

Execution (Lat. *exsequi*, to follow out, carry out). Act of performing anything. It is used in law (*v.i.*), and also in other senses, as in executing a commission, or the execution of a piece of music. In a special sense the word has come to mean the carrying out of a death sentence. In England the death penalty was carried out mainly in two ways, by hanging or by beheading. The former was the fate of the ordinary offender. Beheading was reserved for political offenders and persons of rank.

In England the death penalty was in course of time confined to serious crime, and hanging became the only form. Until 1866 executions were carried out in public. In France persons sentenced to death are publicly executed by the guillotine, and in Spain by garroting. Under the Nazi regime, Germany revived execution by beheading with an axe, and this form of capital punishment is carried out in China with the sword. In the majority of states in the U.S.A. execution is by the electric chair, but in some states murderers are asphyxiated in a gas chamber. See Capital Punishment; Electrocution; Guillotine.

Execution. In English law, term generally used to mean the carrying into effect of the judgement of a competent court. In civil cases this is done by the successful litigant applying to the court for a writ of execution, which as a rule can be had for the asking at an office attached to the court. Some kinds of execution, however, require an order from a judge or judicial officer. Execution is also used for perfecting a legal document by signing, sealing, or delivering it with all proper formalities.

Executive. Name given to a body of men who carry out the orders of others. In most modern states there is a distinction between the executive and the legislature; the latter making the laws which the former carry out. Of recent years in England there has been a tendency for the executive to intrude in the field of the legislature. (See Cabinet; England: Constitution.)

In the U.S.A. the term executive may refer to a director or leading

official of a business organization; it may also (sometimes with the prefix chief) refer to the president or the governor of one of the 48 states or the mayor of a city. Executive Mansion is the old name for what is now the White House, Washington.

Executor. In English law, the person or persons appointed by a will to carry into execution a will as the "legal personal representative" of the deceased. An executor becomes the legal owner of all the deceased's property. His first duty is to arrange for the funeral of the deceased. Then he proves the will, and gets in debts owing to and other property of the deceased. To safeguard himself he should publish advertisements in the London Gazette and in a local newspaper calling for all persons having claims against the deceased to notify them to him. At the end of two months from the advertisement he may distribute the estate, having regard only to the claims notified to him, and will not be personally liable in respect of other claims. In paying the debts he must, if the estate be insolvent, proceed in the order required by the laws of bankruptcy. An executor is entitled to prefer one creditor to another of the same degree, i.e. he may pay one creditor in full even though there are not sufficient assets to pay the other. The executor has also a right to retain out of the estate sufficient to pay any debts which he is owed by it. After payment of debts the executor distributes the estate in accordance with the will of the deceased, but he cannot be compelled to pay any legacies earlier than a year after the death. See Will.

Executory. Term used in English law in two senses. An executory contract is one which consists of a promise on both sides, e.g. I will make you a chair if you will pay me £10 for it. An executory devise is a gift of land by will, where the estate of the devisee is to arise upon a contingency. Since 1925 executory devises and other executory interests can take effect only as equitable interests.

Exegesis (Gr., explanation). Branch of study concerned with the interpretation of Holy Scripture. Properly including all that is connected with the full exposition and understanding of the Bible, it is more commonly restricted to literary interpretation, which determines the sense of the sacred text upon the same principles that would be applied to any other literary work. It differs from Biblical

criticism in taking the text as it stands, and examining its meaning rather than its origin and authenticity. Being concerned not merely with the precise meaning of the text, but with the doctrines and practical inferences to be drawn from it, the study of exegetics is an extensive one.

Exegetes have from early days been divided into two classes: the Literalists took the statements of Holy Scripture in their literal and grammatical meaning; the Allegorists found an inner and spiritual significance underlying the obvious meaning of the text. The N.T. writers afford many examples of the influence of this school. For example, many O.T. passages are applied to Christ which obviously referred originally to contemporaries of the writers. The two schools were long in antagonism, believers in verbal inspiration naturally demanding a literal interpretation of the text of Scripture; while the medieval tendency to read sacramental doctrine into every text of Scripture led to the most far-fetched allegorisation.

The history of exegesis shows a great activity of commentators among both Jews and Christians in the days of the Early Church; but little work was done during the Middle Ages. The allegorical interpretation of a few favourite texts was the subject of most of the books and sermons that could be called exegetical; and collections of patristic comments replaced critical investigation. The Reformation saw a great revival of Bible study, and most of the commentators of this period belonged to the literal school. This may be largely attributed to the need for proving from Scripture the doctrines that were now emphasised, as opposed to accretions to primitive doctrine which owed their existence mainly to allegorical exegesis. *See Bible.*

Exelmans, RÉMY JOSEPH ISIDORE, COUNT D' (1775–1852). A French soldier. Born at Bar-le-Duc, Nov. 13, 1775, he joined the Revolutionary armies in 1791, becoming a captain of cavalry in 1799, after his courageous behaviour during the Italian campaigns. On Murat's staff from 1801, he was promoted general after Eylau, 1807, the climax of his active service during the campaigns in Prussia and Poland. Captured in Spain, he was held a prisoner in England 1808–11. He took part in the Russian expedition, 1812, and at Waterloo commanded a cavalry corps. After

the Bourbon restoration he lived in exile until 1823. His high reputation, however, led to his restoration as a peer of France, 1831, and to his elevation to the rank of marshal. He died Nov. 11, 1852.

Exercise (Lat. *exercitium*). Movements of the muscles, either voluntary or passive. Voluntary exercise means deliberate movement; passive exercises are movements effected by the manipulation of another person or by a machine. Muscular contraction, such as occurs during steady walking, stimulates the circulation of the blood through the muscles. This, in turn, acts on the heart and respiratory system, causing both to act more vigorously. The formation of more waste products in the tissues makes increased demands upon the excretory system.

Severe exercise is beneficial to the young and healthy, but should not be undertaken by persons beyond middle life or those suffering from cardiac or other serious affections. Heavy muscular effort, long continued, such as that of a blacksmith, tends to produce a thickening of the walls of the arteries, which may eventually lead to heart disease, apoplexy, and other diseases, especially if associated with alcoholism or syphilis. Regular daily exercise is an important part of medical treatment in many conditions, for it is the great sedative of the nervous system. Suitable exercises are of value to strengthen the muscles and correct wrong methods of carrying the body, which may have resulted from weakness or curvature of the spine, and other affections which may follow rickets or malnutrition. Graduated exercises are given in treating pulmonary tuberculosis. In paralysis, specific exercises may educate other nerve tracts to take over the duties of the sick cells.

Passive exercises are mainly employed to prevent wasting of the muscles and stiffening of the joints following sprains or fractures, and to increase the mobility of joints in those suffering from rheumatism or similar conditions. *See Physical Training.*

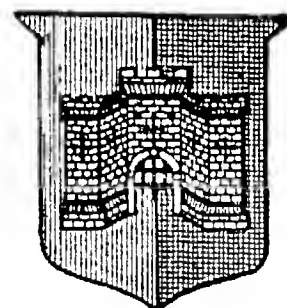
Exeter. British cruiser of the County class, sunk by the Japanese on March 1, 1942. Completed in 1931 at a cost of £2,000,000, the Exeter displaced 8,370 tons on a length of 575 ft. and a beam of 58 ft. Geared turbines developed 80,000 h.p. to give a speed of 32·5 knots. She mounted six 8-in. guns in twin turrets, four

4-in. A.A. guns, four 3-pounders, multiple machine-guns, and six torpedo-tubes. She was one of three cruisers which, on Dec. 13, 1939, engaged and chased into Montevideo harbour the German battleship Graf Spee. The Exeter received 40 hits in the action and suffered 100 casualties, but one of her shells destroyed the enemy vessel's fire-control system. (*See Plate, Battle of the.*)

In 1942 H.M.S. Exeter was with Admiral Doorman's cruiser squadron operating off Java, and in the battle of the Java Sea (*q.v.*) on Feb. 26 was so severely damaged that she had to withdraw for repairs. There was no time to dock her properly, and she sailed with six of her eight boilers out of action. Early in the morning of March 1 two Japanese cruisers were sighted, and a little later two more cruisers and three destroyers came into view. Allied destroyers in escort, H.M.S. Encounter and U.S.S. Pope, attempted to ward off the enemy by launching a torpedo attack, and one Japanese cruiser was hit, but the Exeter received a direct hit in "A" boiler room, which stopped the engines and cut off power throughout the ship. As she lay helpless she was repeatedly hit by Japanese gunfire, until at 11.50 a.m. her commander gave orders to sink and abandon ship. The surviving members of the crew were made prisoners-of-war.

Exeter. City and county borough, river port, and county town of Devon, England; also county of itself since 1537. It stands on the Exe, 171½ m. W.S.W. of London, and has two railway stations. Still partly surrounded by its old walls, it occupies an elevated position on a ridge of land overlooking the Exe.

The chief attraction of the city is its comparatively small but magnificent cathedral, with massive Norman transeptal towers (a unique feature except for a copy in the collegiate church at Ottery St. Mary), dating from the 12th century; the remainder of the edifice, transformed during 1280–1370 from Norman to Decorated style, and restored by Sir Gilbert Scott in the 19th cent., was severely damaged by German bombing, 1942, and again restored. The guildhall, 1330, rebuilt 1464, the episcopal palace, the College of Priest Vicars,



Exeter arms

S. Nicholas Priory, the remains of Rougemont Castle, and Royal Albert Memorial Museum and art gallery are other interesting buildings. The city is the seat of a bishopric, and of the University of Exeter, constituted in 1955. The university was a development of the University College of the S.W. of England, located at Exeter, itself a development, 1908, of extra mural classes organized in connexion with the Royal Albert Memorial Museum, founded 1865. Exeter School, one of the most important public schools in the west of England, was founded in 1629. In 1876 it was reorganized and new buildings were erected: a chapel, gymnasium, laboratory, swimming baths, etc. The old



buildings in the High Street were then abandoned, and the school is now outside the city.

As an important rly. centre, Exeter has a floating basin and is connected with the sea by a ship canal (begun in 1564), which extends 5 miles and opens into the estuary near Topsham. Formerly the seat of an active woollen industry, Exeter is an agricultural centre, with brewing, iron-founding, and Honiton lace and paper manufactures. Market day, Fri. Exeter is a bor. constituency. Pop. (1951) 75,513.

The British Caer Isc, the Roman Isca

Damnoniorum, and the Anglo-Saxon Exancestre, Exeter, as the principal fortified town of the W., was frequently besieged by the Danes and other invaders. It capitulated on terms to the Conqueror in 1068, was surrendered in 1136, successfully withstood attacks in 1467, 1497, and 1549. It surrendered to the Royalists in 1643, but the Parliamentarians were re-admitted three years later. On April 24 and 25 and May 3 and 4, 1942, Exeter was subjected to heavy German air raids, the cathedral and High Street being badly damaged; the library, several churches, and the main building of the city hospital were destroyed. Post-war excavation of the bombed area brought to view remains of two Roman houses. Exeter is the Chatteris of Thackeray's Pendenis. Its motto is Semper Fidelis.

Exeter, MARQUESS AND DUKE OF. English titles borne by several distinguished families. The first duke was John Holand, a half-brother of Richard II and a descendant of Edward I. The son of Thomas Holand, earl of Kent, and Joan, afterwards the wife of the Black Prince, he was made a duke in 1397. He had already married a daughter of John of Gaunt, and had been made earl of Huntingdon. One of Richard's chief assistants, he was condemned and executed in Jan., 1400, for conspiring against Henry IV, his titles and estates being forfeited. After Thomas Beaufort, earl of Dorset, had been duke of Exeter, 1416-26, the title returned to the Holands: in 1443 John Holand, a son of the

executed John, was made duke of Exeter. His son, Henry, lost his title during the Wars of the Roses.

The title of marquess of Exeter was given to Henry Courtenay, earl of Devon, in 1525. He was executed in Dec., 1538, his heirs being deprived of his titles. In 1605 Thomas Cecil, Lord Burghley, a son of the great Lord Burghley, was made earl of Exeter. Henry, the 10th earl, was made a marquess in 1801. An eldest son is called Lord Burghley.

Exeter, DAVID GEORGE BROWN-LOW (CECIL, 6TH MARQUESS OF (b. 1905). British athlete, better known as Lord Burghley. Eldest son of the 5th marquess of Exeter, he was born Feb. 9, 1905, and educated at Eton and Magdalene College, Cambridge. Lord Burghley won the 120

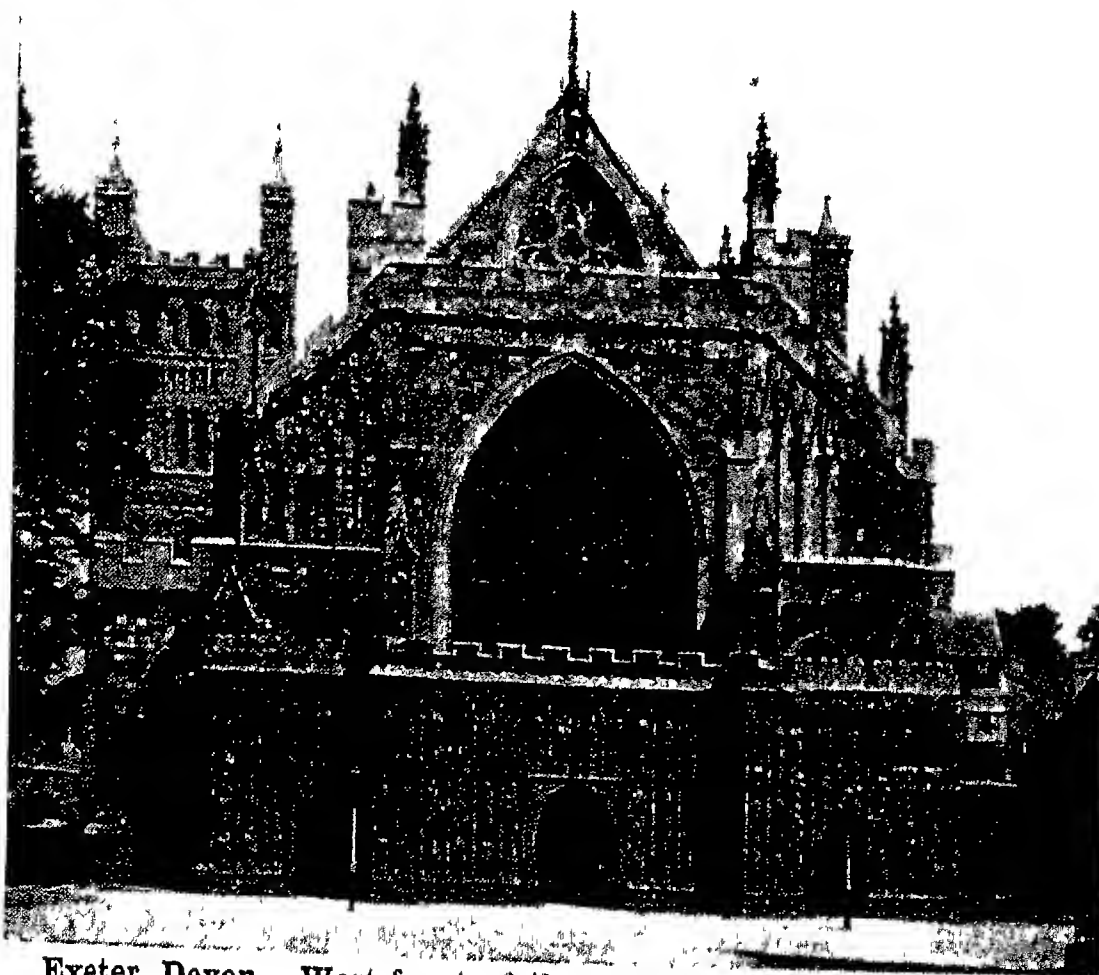


The 6th Marquess of Exeter

and 220 yards hurdles for Cambridge in the inter-university athletic matches, 1925-27, and represented Great Britain in the Olympic Games of 1928 and 1932, winning the 400 metres hurdles in 1928. Burghley was Unionist M.P. for Peterborough 1931-43, and was governor of Bermuda, 1943-45. President of the International Amateur Athletic Federation from 1946, he was chairman of the Olympic Games committee which organized the games held in England in 1948. He succeeded as marquess in 1956.

Exeter Book, THE. MS. collection of Anglo-Saxon poems in the library of Exeter cathedral, to which it was presented in the 11th century by Bishop Leofric. It is clearly written on vellum by one scribe, and forms the most important body of Anglo-Saxon literature that has come down to us. It includes Cynewulf's Christ, The Legend of S. Juliana, a metrical life of Guthlac, Widsith, and The Wonders of Creation.

Exeter College. A college of the university of Oxford. Founded in 1314 by Walter de Stapeldon, bishop of Exeter, it was



Exeter, Devon. West front of the cathedral and the 14th-15th-century screen ornamented with sculptured figures of Biblical characters. Top, left, pillared façade of the Guildhall, added to the original building in 1593

first called Stapeldon Hall, afterwards Exeter Hall, and then Exeter College, being enlarged by Sir William Petre in 1565. It has always had a special connexion with Devon and Cornwall, and certain scholarships are confined to candidates educated or born in the West country.

Famous men educated here were the first earl of Shaftesbury, R. D. Blackmore, and F. D. Maurice. The buildings face on Turl Street and Broad Street, and their chief feature is the 19th cent. chapel, with decorations by Burne-Jones and William Morris, both members of the college. The hall is notable and there is a small but beautiful garden. The head is called the rector.

Exeter Hall. Former public building in London, on the site now occupied by the Strand Palace Hotel. Built in 1831 on land belonging at one time to the marquess of Exeter, it was first the headquarters of the Sacred Harmonic Society, where most of the great singers of the time, including Jenny Lind, appeared. It later became known as the place where the annual meetings of many religious bodies were held. In 1880 it was acquired by the Y.M.C.A., which occupied it until 1907. The hall held 5,000 people.

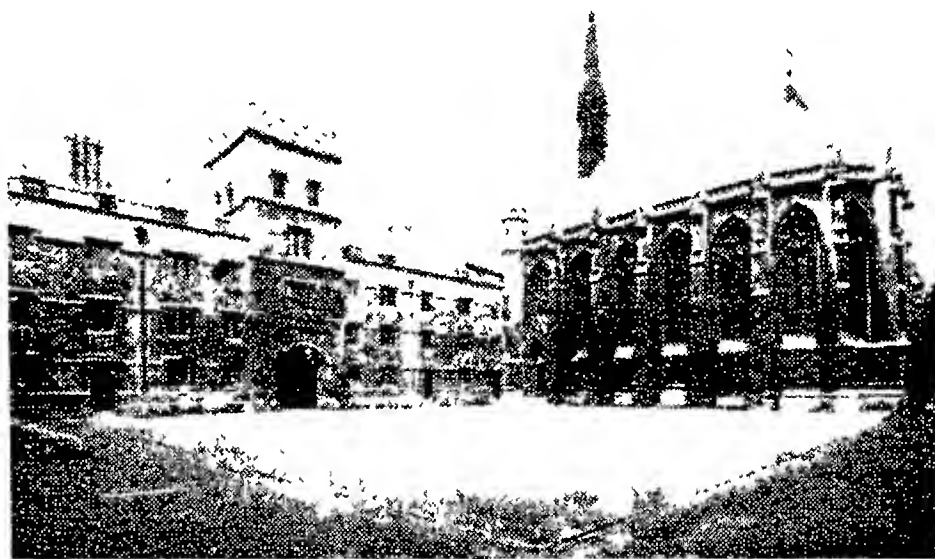
Exfoliation. A form of rock weathering in which the outer surfaces of the rock spall off in flakes or skins, so producing a rounded dome-like shape in boulders or outcrops. It may be the result of alternate heating and cooling of the rock surface by day and night, but experiments do not support this theory. Alternatively, it may be caused by the expansion of rock-forming minerals as they begin to decompose because of chemical combination with percolating rain-water.

Exhaust (Lat. *ex*, from, out; *haurire*, to draw). The stream of burnt gases ejected from an engine; or the exhaust piping itself. In the internal combustion engine the waste gases after combustion are expelled through the exhaust valve and the exhaust port into the exhaust pipe at the exhaust stroke of the piston.

Exhibit. In law, an article or document shown to a witness or a person making an affidavit and identified by him as being an article or document referred to in

his evidence or affidavit. The exhibit is then usually numbered; if an exhibit to an affidavit it is marked by the commissioner for oaths before whom the affidavit is sworn. The commissioner's fee is 1s. 4d. for marking each exhibit.

Exhibition (Lat. *ex*, out; *habere*, to have). Term used for a display or show of any kind. Thus there are exhibitions of pictures and other works of art, e.g. the summer exhibition of the Royal Academy at Burlington House, London. In a special sense the



Exeter College, Oxford. The front quadrangle, showing the fine Gothic chapel
Hills & Saunders

word is used for displays of manufactured goods, and national and international exhibitions of this kind were organized on an enormous scale during the 19th and 20th centuries. These are known to the French as *expositions*. In a sense they are the modern equivalent of the great medieval fairs, although the idea is not so much to sell goods directly as to make them known.

Several exhibitions were held in Paris in the time of Napoleon; the practice of awarding medals was then introduced. Others followed—Great Britain, Germany, and other European countries, the British Empire and the U.S.A. borrowing the idea from France. Some of them were confined to a single industry, and to the products of the home country, but others were wider in their scope. Paris remained the centre of this form of activity, but exhibitions were held in London (1828), Manchester (1837), Leeds (1839), and Birmingham (1849).

The modern international exhibition is regarded as dating from the great exhibition of 1851, in Hyde Park, London. The Crystal Palace was built to accommodate the exhibits, and it was a great success. It was visited by over 6,000,000 people, and from the fund money was set aside for

scholarships—1851 exhibitions they are called—and for other purposes. Other international exhibitions followed: New York (1853); Paris (1855); London (1862); Dublin (1865); Paris (1867); Vienna (1873); Philadelphia (1876); Paris (1878); The Hague (1888); Glasgow (1888). In 1889 a great exhibition was held in Paris, the Eiffel Tower being erected for it. In 1893 there was one at Chicago. Glasgow had another in 1901. The Paris exhibition of 1900 was the largest

till then held in Europe, and in 1904 that at St. Louis again created a record for size. In 1901 a Pan-American exhibition was held at Buffalo, and others were held at Liège (1905), Brussels (1910), Turin (1911), and Ghent (1913). Before the First Great War, beginning with the Franco-British

exhibition of 1908, London staged a series of exhibitions at Shepherd's Bush and Earl's Court.

The British Empire exhibition (*q.v.*) at Wembley, 1924 and 1925, was the first big display after the First Great War; another was in Bellahouston Park, Glasgow, 1938. Paris was the scene in 1937 of an international exhibition of arts and crafts, Chicago in 1933, and New York in 1939 of a World's Fair. In Great Britain the practice has grown of holding annual exhibitions devoted to individual trades or purposes; e.g. the British Industries Fair, Motor Show, Ideal Homes, Radiolympia, Book Fair. See Festival of Britain.

Exhibitionism. A term used by psychologists for behaviour designed to attract attention. It includes the wearing of bizarre clothes and loud and continuous talking; appears in the "naughtiness" of neglected children; and is occasionally seen in actors, writers, and politicians. In Freudian psychology it is particularly applied to the male perversion which consists in taking sexual pleasure in being looked at. This is an inversion of voyeurism, i.e. the desire to look at the object of sexual pleasure.

Exhumation (Lat. *ex*, out of; *humus*, ground). Act of digging up and removing any object from the

ground, but generally applied to the removal of a dead body from its burial place. It is a misdemeanour to do this for any purpose without legal authority. In England such authority may be the Home secretary or coroner where foul play may reasonably be suspected, and the ordinary (*q.v.*) of the diocese when reinterment is the reason. *See* Autopsy; Burial Acts.

Exile (Lat. *exsilium*). Removal from one's native land, either voluntarily or under compulsion. The word probably means "leaping forth," from the root *sal-*, which occurs in *con-sul* and *Salii*, the leaping priests of Mars.

In Greece, exile was chiefly a punishment in cases of homicide, but was also enforced for certain crimes and offences against the state and society. Homicides could anticipate their sentence by voluntary withdrawal, but were liable to be put to death if they returned. Exile was also a political measure employed in troublous times. It carried with it disfranchisement and confiscation of property. A peculiar method of banishment was ostracism (*q.v.*).

At Rome, exile did not become a recognized form of punishment until about the time of the Gracchi. Theoretically, a citizen's life and liberty were inviolable, so the fiction of *aquae et ignis interdictio*, exclusion from the use of fire and water, was invented, since anyone deprived of these necessities in Rome would perforce have to seek a home elsewhere, it being an offence for anyone to supply them to a person under the ban. It is uncertain whether *interdictio* involved loss of civil rights and confiscation. The sentence was at first pronounced by the *comitia centuriata*, and later by the *quaestiones perpetuae*, the standing courts which dealt with serious offences, such as high treason, poisoning, and arson. Anyone could voluntarily leave the city, but was forbidden to return under pain of death.

In early imperial times, *deportatio* took the place of *interdictio*. The condemned person was compelled to take up his abode for life in some place out of Italy, or on some island. He was sometimes allowed to choose the place of exile himself, but generally it was assigned to him. Deportation entailed loss of civil rights and confiscation.

A milder form of banishment was *relegatio*, temporary or for life, pronounced by a higher magistrate or the emperor against any person whose presence in the city was considered undesirable. It entailed

neither loss of civil rights nor confiscation, as is expressly stated by the poet Ovid, who was exiled by Augustus to Tomi on the Black Sea for some unknown offence. *See* Displaced Person; Outlawry; Refugee; Transportation.

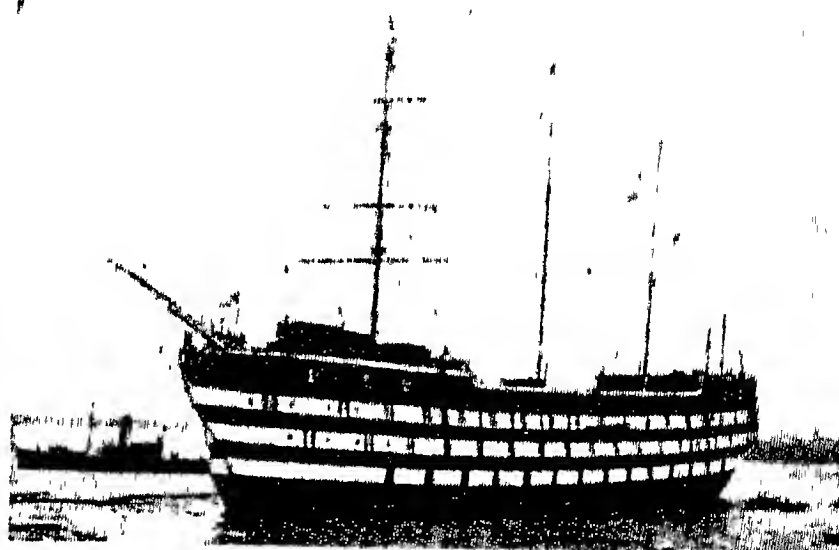
Existentialism. Philosophy of existence, primarily concerned with the nature and experience of the individual. Preoccupied with the nature of being or essence, with individual human consciousness coming into a world of existences, and, above all, with action, it derived in part from Kirkegaard. This philosopher, an opponent of Hegel, declared that "every man is primitively planned to be a self . . . Truth is subjective" (by which is implied that thinking is not handling propositions but living, that thought is not a proposition, but a man thinking). His dictum "choose, leap, and be free," was interpreted by the existentialist philosophers, Heidegger and Jaspers, in the light of an nihilistic doctrine.

Shortly before and during the Second Great War, existentialism gave rise to a French school of philosophers, dramatists, and novelists, of whom the more sensational were Jean Paul Sartre (*q.v.*) and Albert Camus. The atheistic philosophy exemplified in Sartre's *Huis Clos*, or Camus's *L'Étranger*, aroused considerable controversy, not only in France, but in Scandinavia, Great Britain, and the U.S.A. Such works were directly concerned with the problem of man's relations with himself and with others, and received a special hearing at a time when many human beings, often in complete isolation, had to make momentous decisions. *Consult* Existentialism, G. de Ruggiero, 1947.

Ex Libris (Lat., from books). Label of ownership usually called in England a bookplate (*q.v.*). Pasted inside the front cover of a book, it bears the name and device of the owner, preceded by the words *Ex Libris*. This Latin appellation is incorporated in the titles of societies devoted to the study of book plates.

Exmoor. Picturesque elevated moorland expanse in Somerset, England. An ancient forest or hunting ground, area about 20,000 acres, it has few trees. Perhaps three-fourths of the area is covered with heath and heather

and a coarse grass, on which are pastured ponies, sheep, and red deer, the last preserved for stag-hunting. In 1917 Sir Thomas Acland granted a lease of lands covering between 7,000 and 8,000 acres to the National Trust for 500 years, and in 1943 Sir Richard Acland made over the land outright; this area includes some of the finest hill, valley, and woodland scenery of Exmoor. Lorna Doone, Blackmore's romance, has made Exmoor familiar. The river Exe takes its rise here. Other streams are the Barle and the Lyn, and all are fished for trout. The highest point is Dunkery Beacon, 1,707 ft., in the centre. To the S.W. is Span Head, 1,618 ft. *Consult* Wild Exmoor Through the Year, E. W. Hendy, 1946.



Exmouth.
M.N.

Training ship for boys for R.N. and
In 1948 it was renamed Worcester

Exmouth. Former name of a training ship for boys for the Royal Navy and merchant navy, built in 1876, and moored off Grays, Essex. In 1941 she was taken over by the Royal Navy and moved to Scapa Flow as an accommodation vessel; the training school was transferred to Bray Court, near Maidenhead. In 1946 the Exmouth was refitted as a training ship, and in 1948 renamed Worcester (*q.v.*) to take the place of the ship of that name belonging to the Incorporated Thames Nautical Training College.

Exmouth. Urban district of South Devon, England, served by railway. It is on the left bank of the Exe, at its mouth on the English Channel, 10½ m. S.S.E. of Exeter. The first seaside resort to be developed in the county and still among the most popular, Exmouth has three miles of sands and a two-mile promenade. In history it is first mentioned c. 1000 as being in possession of the Danes. Once a flourishing seaport, it contributed ten ships for the attack on Calais in 1347. In the Civil War it sustained a long siege on behalf of Charles I. Besides fishing, brick



Exmouth, Devon. View from the east looking along the promenade and sands towards the mouth of the Exe and the hills beyond it

making is an industry, and all sports associated with a seaside holiday are catered for. Pop. (1951) 17,222.

Exmouth, EDWARD PELLEW, 1ST VISCOUNT (1757–1833). British sailor. He was born at Dover, April 19, 1757, and entered the navy at 13. In 1776 by his gallantry at Lake Champlain (*q.v.*) he secured his promotion to lieutenant. In 1793 he was appointed to the frigate *Nymphé*. For his capture of the *Cléopâtre* he was knighted in 1793, and in 1804 he was promoted rear-admiral and commander-in-chief in India. Returning to England in 1809, he became commander-in-chief of the North Sea, 1810, and of the Mediterranean station, 1811. In 1814 he was raised to the peerage. In 1816, on the refusal of the dey of Algiers to cease his piracies, Exmouth was sent to bombard that city, with the result that over 2,000 slaves were liberated. Made viscount in that year, he died Jan. 23, 1833. The title is still held by his descendants, Pownoll Irving Edward (b. 1908) succeeding as 9th viscount in 1951. A *Life of the 1st viscount* by C. N. Parkinson appeared in 1934.



Exmouth
After W. Owen, R.A

Exmouth Gulf. Inlet of the W. coast of Australia. It penetrates inland about 65 m., and at its entrance is 30 m. across. It is sheltered from the Indian Ocean by a peninsula 80 m. in length, which terminates in the North West Cape.

Exodus. The second book of the Pentateuch, or rather Hexateuch. The title, taken from the Septuagint (Ex. 19), means the "Going-forth." The Hebrew title

is "Names" or "And these are the Names." The book falls into two main divisions: (a) history of Israel in Egypt, chaps. 1–18; (b) account of Moses' administration at Sinai, whither he had led the children of Israel, chaps. 19–40. The former section incorporates a much earlier composition, the Song of the Red Sea (chap. 15). The latter includes the Book of the Covenant. Chap. 20 contains the ten commandments.

Exogamy (Gr. *exō*, outside; *gamos*, marriage). Primitive institution binding a man to marry outside his own social group. The basic family group is normally exogamous since marriage between parent and child, or between brothers and sisters, is prohibited. In its most inclusive form, sometimes referred to as local exogamy, members of a local group irrespective of kinship may not marry each other. Most frequent is an intermediate form, which occurs in societies with unilateral descent groups *i.e.* tracing descent exclusively through either the male or the female line, where its function is primarily the regulation of behaviour. In such societies, *e.g.* the Crow Indians, the individual owes specific obligations to his father's kin, and a different set of obligations to his mother's kin. Marriage within the lineage would no longer allow the two kins to be distinguished, and confusion in the behaviour of individuals towards each other would result.

Exophagy (Gr. *exō*, outside; *phagein*, to eat). The practice among some cannibal peoples of restricting their human food to other than those of their own kin, totem, or tribe. The contrary usage is endophagy.

Exophthalmic Goitre, OR GRAVE'S OR BASEDOW'S DISEASE. Condition due to excessive or disordered secretion of the thyroid gland, the important ductless

gland situated in front of the lower part of the neck. Strong emotion such as fright, worry, or grief may be an antecedent factor, and the lighting up of a septic focus seems in some cases to be a trigger cause, though the essential underlying cause is still unknown. The disease is much more common in women than in men because strain is thrown on the thyroid in menstruation and in pregnancy, and its incidence rises with civilization. A palpitation of the heart and throbbing of the large blood vessels in the neck with a pulse rate of 100–200 beats per minute; exophthalmos, or protrusion of the eyeballs; fine tremor of the muscles of the lower and upper limbs; these are the classical signs of the disease. Emotional change and disbalance are distressing features.

Treatment consists in rest, freedom from worry, and the giving of iodine, but the essential cure is surgical removal of a large part of the gland, enough being left to carry on its normal function.

Exophthalmos. (Gr. *ex*, out; *ophthalmos*, eye). Condition of prominence of the eyeballs, or of apparent prominence of them caused by retraction of the eyelids. It is associated with exophthalmic goitre, hyperthyroidism, and other less common physical conditions. Exophthalmos, once established, tends to persist.

Exorcism (Gr. *ex*, out; *korkizein*, to adjure). The expulsion of malign spirits by ritual means. Belief in demon possession and demon obsession is revealed in early Sumerian inscriptions. The Semitic Babylonians regarded most mental and bodily ailments as due to intrusive demons, whose expulsion was sought by the incantation of charms containing a divine name, fortified by material aids. Exorcism passed into the Greco-Roman world, was rife in W. Asia in N.T. times, was taken over by early Christianity, and survives here and there in ecclesiastical ritual. Baptismal exorcism is retained by the Roman and Old Lutheran communions.

In primitive culture disease is commonly attributed to evil magic wrought by one person upon another. The intrusive evils, whether human hosts or non-human demons, may haunt persons or places. Preventive exorcism is one chief purpose of the amulet. Expulsion may be attempted by sympathetic magic, such as the Babylonian wasting of a wax effigy of the sorcerer, or the

Dakota shooting of a bark effigy of the demon.

Ills may be driven out by drums, as in Patagonia, or other musical means, as in the story of David and Saul; they may be transferred to scape-animals, such as fowls, as in W. Africa; to goats, as in Arabia; or to swine (Matt. 8). They may be enclosed in a receptacle left by the roadside, or thrown into the stream, as in Uganda; conjured into a proa, driven out to sea, as in the Malay archipelago; or attached to a rag or wisp of hair suspended from a tree. An appeal or command addressed to the demon may be fortified by a promised sacrifice or a vow. See Demonology; consult also The Golden Bough, J. G. Frazer, new ed. 1922.

Exoskeleton. Zoological term for the hard structures produced by modification of some or all parts of the integuments of animals. It acts as a support or a protection or both for the softer organs within, and to it muscles may be attached. Examples are among the Arthropoda, *e.g.* crabs, lobsters, spiders, and insects. Less obvious examples are the scales of reptiles and fishes, the feathers of birds, and the fur of mammals.

Expansion (Lat *ex*, from, out; *pandere*, to spread). Increase in the dimensions of a body. It may result from a change of temperature or state. The recognized coefficients of thermal expansion are (a) linear, defined as change in length per unit length per degree rise in temperature; (b) areal or superficial, defined as the change in area per unit area per degree rise in temperature; and (c) volume or cubical, defined as the change in volume per unit volume per degree rise in temperature. The linear and areal coefficients are applicable only to solids and for an isotopic material are approximately one-third and one-half respectively of the volume coefficient. In some substances, *e.g.* crystals, the value of the linear coefficient will differ in different directions. The magnitude of expansion for a solid is quite small; an iron bar one metre in length will expand by approximately one millimetre when heated from 0° C. to 100° C. Typical values of linear thermal expansion coefficients (per degree C.) are as follows:—

Platinum	..	0.0000089
Copper	..	0.0000168
Zinc	..	0.0000292
Glass	..	0.0000083
Quartz (crystal)		
axis	..	0.0000075
⊥ axis	..	0.0000137

The fact that platinum and certain kinds of glass have almost identical coefficients allows the making of airtight seals of platinum wire in glass. "Invar," a patent nickel-steel with an expansion coefficient of the order of 0.000001, is used in clock pendulums.

Liquids and gases have to be contained in vessels which also expand, and so what is directly observed when fluids are heated is the apparent expansion. The apparent does not differ appreciably from the true expansion in gases, whose expansion (cubical) coefficient is much larger than that of solids. The mean coefficient of volume expansion of mercury between 0° C. and 100° C. is 0.000182. Water decreases in volume between 0° C. and 4° C., when its density is a maximum; thereafter it expands until it changes state at boiling point.

Another physical condition to modify the size of a body is the application of a magnetic field. With nickel a marked decrease in length is shown, and the phenomenon, known as magnetostriction, is applied to the construction of mechanical oscillators.

Expansion of the Universe. The extragalactic nebulae are found to be receding from the sun at speeds which increase proportionally to their distances. The universe thus seems to be expanding at a rate which doubles all distances in about 1,300 million years. This fact suggests that the universe may once have been confined to a relatively small volume of space, the separate galaxies moving at different speeds which have in the course of time carried the fastest-moving ones farthest away. The equations of the general theory of relativity have various possible solutions, some of which correspond to an expansion of space itself which may be the cause of the observed recession of the nebulae.

Ex parte (Lat., from one side). Expression used in English law to signify something done or said by one person not in the presence of his opponent. Thus an *ex parte* application is one made in the absence of the other side. An *ex parte* statement is one made when no one present can contradict it.

Expectant. Term used in English law. An expectant estate is one that comes into possession and enjoyment when some date arrives or event happens. Reversions and remainders are the only expectant estates known to common law; but when wills of land were allowed the law permitted executory interests.

An expectant heir is one who is bound to come into property on the death of another.

Expectation of Life. Term used by actuaries and others engaged in life insurance business for the number of years a person may be expected to live. By careful calculations tables have been worked out which are used when annuities are bought and sold. The expectation differs for males and females, and for different ages, but a roughly accurate method is to value the expectation of life at two thirds of the difference between the present age and 80. Thus a man of 41 may count upon living to 67, this being 26 more years, two-thirds of 39, which is the difference between 41 and 80. Some writers have objected to the term, and equation of life has been suggested as a substitute. See Annuity; Death Rate; Insurance.

Expectorant (Lat. *ex*, out; stem, *pector*-, breast). Drug which assists the expulsion of mucus from the lungs and air passages. Such drugs include ammonium carbonate, senega, squills, ipecacuanha, benzoin, and balsam of tolu.

Expeditionary Force. Military formation sent overseas from its home bases for operations in foreign territory. After the British army was reorganized in 1900, an expeditionary force of regular troops was trained and held in readiness for immediate service abroad. The force consisted of six divisions of infantry, one division of cavalry, and ancillary troops, totalling some 140,000 men. This was the British Expeditionary Force (*q.v.*) that landed in France in Aug.-Sept., 1914. Throughout the First Great War, the term was applied to any important military force sent out to a separate theatre of war under an independent commander. Thus the Mediterranean Expeditionary Force fought in Gallipoli, Salonica, and Egypt, the Italy Expeditionary Force was sent to the assistance of Italy, and the Archangel Expeditionary Force assisted the White Russians in the war against the Bolsheviks. The U.S. troops in France in 1918 were known as the American Expeditionary Force.

The peace-time organization of a British Expeditionary Force was altered by including in it a Territorial Army Field Force. In Sept., 1939, an expeditionary force of some 150,000 regular and territorial troops, later expanded to nearly 350,000 men, crossed to the Continent. The N.W. Europe Expeditionary Force, consisting mostly

of young militiamen, went to Norway in April, 1940. The British 9th army based in Syria, Iraq, and Palestine was known as the Mediterranean Expeditionary Force, while the Anglo-American troops invading Normandy in 1944 were called the Allied Expeditionary Force (*q.v.*). But during the Second Great War the term expeditionary force was less widely used, other designations being favoured, *e.g.* Balkan Land Force, South-East Asia Command.

Expenditure (Lat. *ex*, out; *pendere*, to weigh). Act of paying out money. In large firms expenditure passes through the counting-house and is checked by the auditors. National expenditure is voted by the house of commons, and the expenditure of local authorities, which is under the control of finance committees and officials acting under their orders, is checked by auditors of the appropriate government department. See Accountancy.

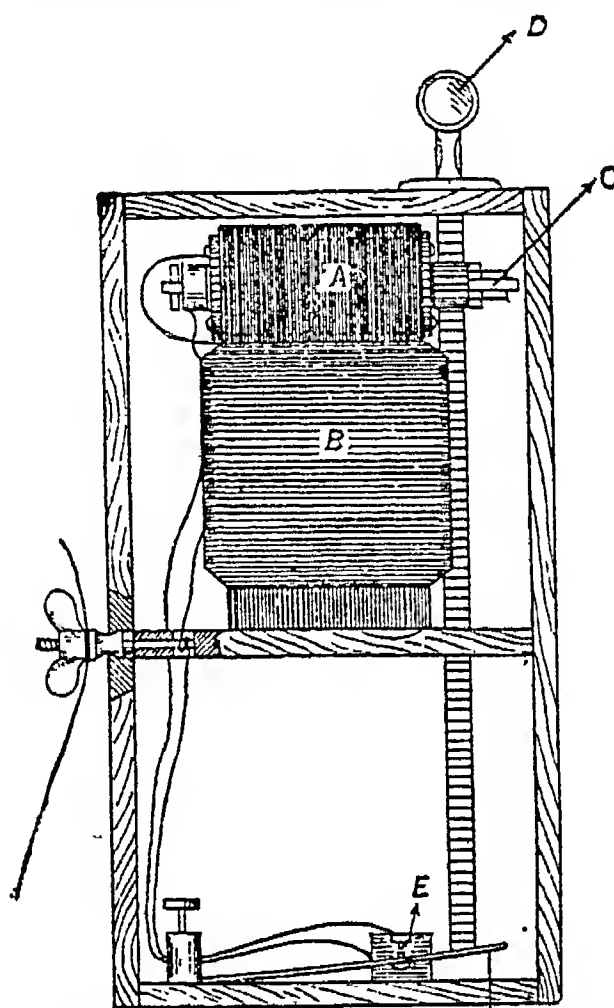
Experience (Lat. *experiri*, to try). The effect upon organisms of interaction with their environments as it is interpreted by their minds. Both Plato (Republic) and Kant (Critique of Pure Reason) realized that subjective factors colour experience of the external world, but Plato exaggerated their effect upon the validity of sense knowledge, and Kant limited them to certain categories—*e.g.* cause and effect—and failed to realize the part played by such factors as instinct and emotion. Every experience modifies the attitude of the mind to subsequent stimuli, especially those of the same nature. The extreme case is the violent shock which renders a person insane.

Evolution in the animal kingdom is accompanied by an increase in the power of learning from experience. This power is almost absent in insects, but it has developed in man until he is a being possessed of reason—able by comparing, contrasting, and evaluating experiences, and drawing correct deductions from them, to arrive at accurate knowledge. One of the most important recent psychological discoveries is that all experience is stored in the unconscious mind and that much of it, in appropriate circumstances, influences subsequent conduct without there being awareness of it. See Unconscious.

Experiment. Testing a provisionally adopted theory by facts. The great progress of natural science in modern times has been

chiefly due to the systematic employment of experiment. Ancient philosophers and inquirers had a contempt for this method, which first received due recognition by Francis Bacon in his *Novum Organum*, 1620. An experiment may be defined as an observation which can be repeated, varied, and explained.

Experimental Farm. Farm at which soils, crops, the science of manuring, and other subjects cognate to agriculture are studied and from which the results of investigations are issued for the guidance of farmers. An example is Rothamsted, Herts, which was founded by Sir John Lawes in 1843 and still operates in a greatly extended form. Woburn, Beds, was



Exploder. Sectional diagram of magneto exploder. For explanation of lettering, see text

established by the Royal Agricultural Society, and later stations such as Aberystwyth, Cambridge, Corstorphine, Glasnevin, and Stormont were brought into being for the study and improvement of crop plants. East Malling and Long Ashton have made a special study of the problems of fruit growing. The National Institute of Agricultural Botany, Cambridge, was established 1919 to determine the comparative value of crop plants on a geographical basis. In the British dominions and in all foreign countries whose agriculture is sufficiently organized, experimental farms have been set up. See Agricultural Bureaux.

Expert (Lat. *expertus*, tried). In English law, the term used to describe one who has special skill in and knowledge of a trade or profession. Experts are often

called to give their opinions in technical cases.

Exploder. Term designating the electric machine for firing blasting charges fitted with electric detonators. Exploders occasionally utilise current from a set of accumulators passed through an induction coil, but the more usual machines are of the magneto type, a sectional illustration of such a machine being shown. It consists essentially of a double-wound armature, A, which can be rotated between the poles of the horseshoe magnet, B, through the free wheel pinion, C, which is actuated by the rack, having a hand grip, D, at its upper end. The free wheel ensures that the armature does not rotate as the handle is pulled up, but only when it is pushed down and the current is normally short-circuited by the switch, E. When the rack reaches the bottom of its stroke, and the armature is revolving at maximum speed, the rack opens switch E and the whole of the current passes to the main leads secured by the wing-nuts shown on the left, and thus to the detonators. A machine of this type weighs some 16 lb., and can fire simultaneously up to 100 charges.

Exploitation (old Fr. *exploit*, profit). Stage in the life of a mine when ore is extracted and sold, the previous stages being prospecting and development. During the earlier periods the money expended is regarded as capital invested in the business; during exploitation the revenue from sales is regarded partly as return of the capital expended and the interest thereon. See Mining; Prospecting.

Exploits. River of Newfoundland. The longest river in the island, it rises in the hills of Long Range and flows right across in a N.E. direction. It passes through a well-wooded district which supplies timber for the pulp mills, and on it is the town of Grand Falls. It empties itself into the Bay of Exploits, having drained about 4,000 sq. m. Its length is about 160 m., and it is navigable by steamers for 12 m.

Exploration (Lat. *explorare*, to search out). Literally, any kind of discovery, but the word is applied specially to discovering and making known the hitherto unknown parts of the world. There was little in the way of exploration from the time of the Greeks to almost the end of the Middle Ages.

In the 13th century something became known about China, and

Marco Polo may fairly be ranked as a pioneer of exploration. It was, however, towards the end of the 15th century that the great discoveries were made that gave a remarkable impetus to the work of the explorer. In 1492 Columbus reached the W. Indies; in 1497 Vasco da Gama rounded the Cape of Good Hope, and reached India; while about those years notable voyages were undertaken by Bartholomew Diaz, the Cabots, and others. Newfoundland was discovered; Cabral reached Brazil; Balboa saw the Pacific. From these discoveries followed the exploration of America. In the N. the lead was taken by Frenchmen, La Salle being one of the greatest names, and in the S. by the Spaniards and Portuguese. Gradually the nature and extent of the two continents were made known; the Amazon and the Mississippi were discovered and then explored, while the secrets of the wonderful Aztec civilization were revealed.

In the 18th century Australia was discovered by Captain Cook, although the Dutch Tasman had some time before found Tasmania and New Zealand. Early in the 19th century the continent was explored by Oxley, Sturt, Eyre, and a host of others. More and more was becoming known of Asia, although it was long before its central area was explored by Hedin and others, the final stage being the entry into Lhasa, 1904. In the 19th century, too, came the exploration of Africa, the work of Livingstone, Stanley, Hanning, Speke, and others among Englishmen, as well as a number of Frenchmen and Germans. The secrets of the Nile and the Congo were revealed, and soon there was little for the explorer to do.

From the time of the discovery of America, explorers had turned their attention to a north-west or north-east passage, and from this came the desire to reach the North Pole. The South Pole, too, was aimed at, and the exploration of the world's surface may be said to have ended when these goals were reached. See Antarctic Exploration; Arctic Exploration.

Explosion. A very rapid chemical reaction accompanied by the liberation of heat and the simultaneous liberation of gaseous products. Combustion, whether of hydrogen, petrol, or coal, is a rapid oxidation reaction, *i.e.* combustion takes place by reaction with oxygen which may come from the air or be supplied by an oxygen carrier such as sodium nitrate in

gunpowder. The high temperature produced in these reactions usually gives rise to luminosity or flame. Explosions are not always oxidation reactions; simple substances, liquid, solid, or gaseous, not containing oxygen (*e.g.* acetylene, lead azide) may explode spontaneously when suitably set off.

In certain circumstances, dust may be a contributory cause of an explosion, particularly in mills, grain elevators, or coal mines. Though not explosive in itself, coal or flour dust is highly inflammable, and if it comes into contact with flame, or even a weak electric spark, combustion takes place by reaction with the oxygen in the air. The dust nearest the source of heat is first ignited, and then the flame passes from particle to particle of the dust until it has all been consumed. The explosive force generated by dust is equivalent to that generated by the ignition of petrol vapour.

Explosions are usually the results of chemical changes, but the term is also used in reference to processes of a purely physical nature, such as the explosion of a steam boiler or the bursting of a beer bottle. These effects result solely from the sudden expansion of a high pressure or by volatilisation of liquefied gases.

Rate of Combustion

When a gaseous mixture, *e.g.* coal gas and air, or hydrogen and oxygen, is ignited by a hot wire or an electric spark, flame is propagated through the mixture at a uniform rate, which may vary from a few to many hundred centimetres per second. In a closed tube the initial flame speed may accelerate rapidly to a much higher constant velocity of several thousand cms./sec. This is known as detonation.

These factors determining the rates of combustion are important in connexion with the internal combustion engine and other oxidation processes. The motive power of the internal combustion engine is produced by the explosion of a mixture of inflammable hydrocarbon vapour and air in suitable proportion, and the engine's efficiency depends partly on the rate of pressure development in the explosion relative to the speed of running. Ignition of the mixture in the cylinder is produced either by a spark or by rapid compression of fuel (compression ignition). Detonation of the mixture in the cylinder gives rise to the phenomenon of "knocking" or "pinking," and is reduced by the

addition of anti-knock agents, such as lead tetraethyl, to the fuel.

BLAST. The destructive effect of an explosion is not restricted to the point of ignition but, owing to blast, may cover a wide area. Blast is produced by the sudden liberation into the atmosphere of gas at high pressure, blankets of air being displaced in various directions from the centre of explosion, with greater or less violence according to the intensity of the explosion. This displacement creates pockets of strong compression and suction, due only indirectly to the gaseous products of the explosion.

How Blast Causes Destruction

Blast is transmitted in the form of a wave, its velocity approximating to that of a sound wave in air (1,100 ft. per sec.). This creates a change in the air pressure, and the positive change so created in the normal air pressure is much greater than the negative, as the actual pressure can never fall below zero. Thus blast first creates a pressure wave against any object in its path; then, as the wave is dissipated and the natural atmospheric pressure returns to normal, a partial vacuum is created which acts as a sudden pull against the affected object. Although the suction is weaker than the original pressure, it lasts several times as long, and normally does damage to objects which had not time to weaken under the usually brief initial pressure. Frequently it is the pull that causes destruction. Provided the pressure wave lasts long enough, it will set up vibration in the objects in its path and they will oscillate in sympathy with the following pull when it arrives. In other words, objects and pull will be in resonance, and the former will collapse. Objects built of timber or having many joints have a high frequency of vibration and are more liable to be ruptured by blast than those of low frequency; a solidly built concrete structure has low frequency and is therefore resistant to blast. It is the dual push-and-pull action of blast on obstacles in its path that produces contradictory effects. Some buildings in the blast area may be destroyed by the initial forward movement of the pressure wave and fall before it, while others will collapse under the pull effect in the opposite direction.

Blast generally spreads outwards with a steep incline at the point of initial explosion, but quickly curves back towards the ground.

This explains why objects in the immediate vicinity of impact may be unaffected, while buildings some distance away will collapse.

The intensity of blast of a shell or bomb is governed by five factors: the type of explosive, the size of the projectile, the detonation velocity (*i.e.* the wave motion through the mass of the explosive), the thickness of the bomb or shell casing, and the type of ground upon which the projectile falls. For a given weight and type of explosive, a thin-cased bomb has a greater blast effect than one with a thick case; while any bomb falling on soft ground has a lower blast effect than one making contact with a hard surface, such as concrete or steel. Owing to the enormous pressure generated by an atomic bomb (*q.v.*) explosion, objects in the path of the blast are usually destroyed by the initial pressure wave, so that most objects have already collapsed when the pressure drops and the pull in the opposite direction is exerted.

Animal and human victims of blast are killed either by the concussion of the initial pressure wave or by the pulling effect created by the resultant vacuum. In the latter event the air is extracted from the body; the lungs collapse and the internal organs break up owing to the evacuation of the air supporting their interiors. This causes death, and such victims of blast show no outward sign of injury.

The high pressure wave generated by an explosion striking the Corti organ of the ear gives the impression of a loud sound at the seat of the explosion. Actually, the noise of detonation is not generated by the explosion, but is received by each hearer individually according to the path of the pressure wave. Thus, a person some distance from the explosion may hear a very loud noise, whereas another person, closer to the explosion, but shielded by a building or rising ground, receives a much weaker sound impression.

High explosives differ a great deal from one another in their sensitiveness to detonation. Blasting gelatine may be set off by the detonation of a sensitive explosive, placed in close contact with it. Such "initiator explosives" are generally used either alone or in mixtures in detonators. The most important members of this class are mercury fulminate and lead azide. Many high explosives require the interposition between the detonator and the high explosive of a sensitive explosive called an "exploder," "booster," or "gaine."

HISTORY. The early history of explosives and their actual invention is a matter of much speculation. Gunpowder is certainly the oldest. It is sometimes connected with "Greek fire," used in the Byzantine period, but it is doubtful whether saltpetre of sufficient purity was known at the time. Saltpetre was known to the Chinese and Arabic people about 1200, and they used it in fireworks for military purposes. Roger Bacon (1214-94) in his writings made undoubted references to gunpowder, using a cipher to conceal instructions for its manufacture, and he was acquainted with the fact that it explodes violently when ignited in confinement. The use of gunpowder for the propulsion of missiles from guns is said to have been introduced by a German monk, Berthold Schwartz. Old manuscripts record different dates for this event; but guns were certainly in use by 1320.

For some six centuries gunpowder remained the only known explosive, and its composition remained almost unchanged, saltpetre, charcoal, and sulphur being the ingredients, in varied proportions. Its progress from an uncertain, irregular medium to a uniform and reliable explosive was due to improved manufacturing methods and greater purity of ingredients, this tending to more intimate contact of the components and consequently to faster and more regular burning.

In 1846, nitrocellulose and nitroglycerine were discovered, the former simultaneously by two Germans, Schönbein and Böttcher, and the latter by an Italian, Sobrero. Both proved to be extremely violent explosives, incomparably more powerful than gunpowder. The reason for this is that both are chemical compounds, the oxidiser and combustible being combined in the same molecule, and hence in the

EXPLOSIVES: IN PEACE AND WAR

G. E. H. Bawn, Ph.D., Professor of Chemistry, Liverpool University

In addition to this general article, this work contains articles on special explosives, e.g. Dynamite; Gunpowder; Picric Acid; Trinitrotoluene, etc. See also Ammunition; Artillery; Detonator; Fuse; Gas, etc.

Explosives (*Lat. explosus*, driven out) are solids or liquids or mixtures which, when chemical change is initiated at any point within them by heat or by a blow, can be converted in a very short time into stable substances that are wholly or mainly gaseous. The disruptive or propulsive effect of the explosive is produced by the sudden formation of gaseous products at a high temperature. The name "explosive" is limited by custom to solids or liquids, although many gaseous reactions are truly explosive. The production of gases at a high temperature, some of which are also readily combustible on admixture with the outside air, gives rise to the flame usually associated with explosion, although certain compounds, such as azide, explode without visible flame. In blasting explosives, the chemical reactions involved are oxidations; one constituent of the powder is oxidised by the oxygen contained in another (for example, the charcoal in gunpowder is oxidised by the potassium nitrate) or one portion of the chemical compound oxidises another portion of itself, as in the explosion of nitroglycerine or trinitrotoluene (T.N.T.). The explosion results from the fact that

the chemical changes occurring give out heat and that the reaction, once started, becomes self-supporting and spreads rapidly throughout the mass.

Many explosives, *e.g.* T.N.T., will burn quietly when ignited by a flame in an open space; others, such as mercury fulminate or lead azide, explode violently under whatever condition they are ignited. The latter substances also explode when struck by a hammer. Other initiating agencies include friction or rubbing, electric sparks, shock from an adjacent explosion. Differences in behaviour of explosives are due to their different speeds of reaction, resulting from the nature of the substance and the type of initiation of explosion: the explosion of gunpowder or cordite, even when strongly confined, is essentially a rapid burning, whereas with mercury fulminate or confined T.N.T. a very short period of burning rapidly culminates in a violent explosion with the production of an intense shock wave which is known as a detonation. These differences in speed of reaction determine the use of the explosive to produce a propulsive (propellant) or disruptive (high explosive) effect.

closest possible contact, far closer than can be achieved by mechanical mixture in gunpowder. They are types of a distinct class of explosives, termed the nitric esters, in which the hydroxyl groups (OH) of the raw material are more or less completely replaced by nitrate groups (ONO_2) during nitration.

Nobel's Discoveries

Attempts to use these new substances commercially showed a number of unexpected difficulties. One problem was how to ignite them. A spark or flame had been the accepted method of firing gunpowder, but was inadequate for the new explosives which, however, were easily exploded by percussion. The ignition problem was solved by a Swedish chemist, Alfred Nobel (*q.v.*) who, in 1864, showed that mercury fulminate, previously used only in percussion caps for firing gunpowder, when exploded by a spark initiated complete detonation in nitroglycerine. Nobel's discovery, a landmark in explosives science, made possible the use of most modern high explosives.

Nitroglycerine is highly sensitive to percussion, and so many accidents attended its early manufacture and use that in many countries it was prohibited as a blasting explosive. After a number of dangerous experiments, Nobel in 1866 discovered that kieselguhr will absorb about three times its weight of nitroglycerine, yielding a plastic mass of sufficient insensitivity which he named dynamite. Its rapid adoption founded Nobel's fortune. Nitrocellulose in the form of guncotton began to be used as a military blasting explosive in 1868. Neither of the new explosives, however, could be used in guns, being too violent in their action, whilst they were too sensitive for shell fillings. Mixtures of ammonium nitrate with various combustibles, introduced in 1867, were found too insensitive for use as explosives until nitroglycerine was added. Another class of explosive—mixtures of nitric acid with organic combustibles—was invented by Sprengel in 1871, their essential feature being that the ingredients were non-explosive until mixed just before use. These were used for blasting on the Continent until replaced by more permanent solid compositions.

Sprengel also experimented with picric acid, or trinitrophenol, in 1871, but this explosive was not taken up until 1885, when Turpin proposed its use for shell filling.

The first high explosive sufficiently insensitive for this purpose, it belongs to a new class—the nitro derivatives of the aromatic hydrocarbons. Smokeless powder (nitrocellulose whose structure has been modified by gelatinisation) was used successfully as a propellant for sporting gun ammunition in 1865, and for military purposes in 1884. Its decomposition in this form was extremely rapid combustion rather than explosion.

Picric acid was found to be liable to form picrates, which are sensitive, and in itself proved somewhat too sensitive for use in shells for large guns. Nitration of other aromatic hydrocarbons was therefore attempted, but did not become a commercial success until the manufacture of cheap, highly concentrated sulphuric acid was a commercial possibility. Trinitrotoluene then sprang into prominence, becoming the basis of military high explosives.

Types of High Explosives

High explosives are of two classes: (1) primary or initiator explosives, which are very sensitive and detonate when heated or subjected to shock, such as a blow; (2) secondary explosives, which detonate under the influence of shock from a detonated, initiating, or another secondary high explosive. The initiatory type of explosive is used almost entirely in making detonators or caps, whilst those of the secondary type are used to fill shells, bombs, mines, and torpedoes, and for blasting.

MILITARY HIGH EXPLOSIVES are few in number, the principal being trinitrotoluene (T.N.T.), picric acid, tetryl (C.E.), amatol (ammonium nitrate-T.N.T. mixture), ammonium picrate, hexyl, R.D.X. (cyclonite), and penta-erythritol tetranitrate (P.E.T.N.).

An explosive must conform to very stringent standards before it is acceptable for military purposes. Besides possessing the necessary power, it must be (1) sufficiently insensitive to shock and blow for safe handling in the field and in the factory, (2) resistant to deterioration on long storage in filled weapons, and (3) non-poisonous, non-volatile, stable, and non-absorbent of moisture. Easy production from available materials is also desirable.

During the Second Great War, several new explosives were developed, especially to meet new and specific requirements such as demolition of large fortifications, penetration of heavy armour and concrete, and the production of

high blast effect. Among the more important of these were R.D.X. (used in depth charges) and P.E.T.N. The older explosives, T.N.T., amatol, picric acid, tetryl, and hexyl, developed during the First Great War were, however, used more extensively. The very high demand for explosives during the war resulted in the loading of ammunition on a mass production scale by the use of melt or cast loading, in which the high melting explosive, *e.g.* ammonium nitrate or R.D.X., was mixed with the lower melting T.N.T., the weapon being filled with the resulting thick slurry. Aluminium powder was often used in addition in these explosives, to enhance the blast and incendiary effect of the filling.

BLASTING EXPLOSIVES are extensively used in mines and quarries and in civil engineering to supplement the work of man and machine in breaking down for removal rock, coal, or other material. They are divided into two groups, (1) permitted, those whose use is allowed in coal and other mines where there is danger of explosions of firedamp and air and of coal-dust and air, (2) non-permitted, use of which is allowed only in quarries and for other open work where there is no danger of gaseous or dust explosion. Explosives must pass a stringent government test before they are placed on the Home office and Board of Trade lists (published annually) of permitted explosives.

Materials for Blasting Operations

Blasting explosives can be classified according to whether their sensitive explosive component is nitroglycerine or another high explosive material. Nitroglycerine explosives are subdivided according to their physical state into gelatines, semi-gelatines, and powders; and into permitted and non-permitted explosives. Nitroglycerine freezes at 13°C . (55°F .) and at that temperature all explosives containing it freeze to a hard mass unsuitable for use. Failures from this cause have led to accidents, and all nitroglycerine explosives used in Great Britain are therefore of low freezing type, *i.e.*, they do not freeze at any temperature likely to be encountered in that country. This is achieved by replacing about $\frac{1}{4}$ of the weight of nitroglycerine by nitroglycol, and the term N/G in this article is used for this mixture.

The parent gelatine in blasting gelatine is the strongest known

commercial explosive; it contains over 90 p.c. N/G, the remainder being nitrocellulose with a small quantity of stabiliser. Other gelatine compositions have been developed by replacing part of the N/G by other oxidising ingredients such as potassium nitrate, sodium nitrate and ammonium nitrate, carbonaceous material such as wood meal being added to take up the excess oxygen liberated in the explosion. Permitted gelatines are made by incorporating into the non-permitted a fairly large quantity of inert substance—sodium chloride is generally used—which reduces the temperature and also the power of the explosion. Semi-gelatines contain a higher proportion of solid ingredients than the gelatines, but the powder is still bound by a nitroglycerine jelly. The ammonia dynamites, in which ammonium nitrate provides the chief source of power, belong to this class. The original nitroglycerine blasting powder was dynamite, which consists of N/G absorbed by a siliceous earth, kieselguhr. Since the latter substance is inert and reduces the power, combustible absorbents were developed, mixed with sodium nitrate as oxidising agent. Most of the nitroglycerine was later replaced by ammonium nitrate, an explosive substance as well as an oxidising agent, but sufficient nitroglycerine was left to sensitise the mixture.

In the non-nitroglycerine type of blasting explosive, the sensitiser is usually T.N.T., which is mixed with a metallic nitrate or ammonium nitrate to compensate for its lack of oxygen. Permitted non-nitroglycerine explosives are made by the incorporation of salt into the composition.

PROPELLANTS are self-combustible materials which, on ignition and acting against a movable resistance such as a bullet or shell in a gun barrel, produce by virtue of the production of gases at high pressure and temperature a propulsive effect. Such explosives on initiation by a cap give a rapid combustion, the rate of which is markedly dependent on pressure, but very many times lower than the velocity of detonation of high explosives. Propellants in actual use are based upon nitrocellulose; many powders contain in addition nitroglycerine and other explosives.

Guncotton and collodion cotton can be used in their fibrous form, but in service propellants of the cordite type, and in many non-military powders, the fibrous structure of the nitrocellulose is to a

considerable extent destroyed by colloidising (gelatinising) with a solvent for nitrocellulose. Propellants are classified as single or double base powders, according to whether they contain nitrocellulose alone or with other explosives. American service powders are, in the main, single base, whereas in British cordites the nitrocellulose is gelatinised with the powerful explosive nitroglycerine.

Besides the main ingredient and stabilisers to increase the keeping properties of the propellant, other substances are added for special purposes. Some powders contain "flash reducers," which act as cooling agents and serve to prevent the blinding flash which occurs when the hot combustible gases leaving the muzzle of the gun mix with the external air. Flashless charges developed during the Second Great War made it possible to fire at night-time without disclosure of the position of the gun. Moderants or deadeners such as oils or wax are sometimes added to control the speed of combustion. Military gun propellants are made by an extrusion process in the form of threads, tubes (single or multi-perforated) which vary in size from $\frac{1}{16}$ in. to $\frac{1}{2}$ in. or more according to the size of the gun, and the shell velocity required.

Small arms propellants usually consist of a bundle of thin cordite sticks or threads.

Second Great War Developments

Liquid rocket propellants were developed during the Second Great War. Fuel and oxidant, carried in separate tanks, were forced into the combustion chamber. The products of combustion, on passing out through a jet, provided the propulsive action, as in a normal rocket based on a powder propellant. In the German rocket (V 2), whose range was about 200 miles, the liquids used were liquid oxygen and alcohol. Another major fuel development during the war was the production of concentrated hydrogen peroxide, which could be decomposed almost instantaneously to give oxygen and steam when permanganate solution was mixed with it. The superheated steam plus oxygen generated was used to operate the turbine fuel pumps of the V 2 and for the direct propulsion of a rocket-propelled glider bomb. The German rocket-propelled fighter—the Me 163—was operated on the bi-fuel system—hydrogen peroxide (T-Stoff), and a mixture of hydrazine hydrate and alcohol (C-Stoff). The latter was also used as cooling agent.

Non-military propellants, used for shot-gun, revolver, and rifle powder (sporting powders), and also for power purposes, are, like military powders, based on nitrocellulose and may be classified in three main groups on the basis of their composition and physical structure:

Propellants for Civilian Purposes

(1) Fibrous nitrocellulose (N/C) powders, in which the N/C substantially retains its fibrous structure. These are fast powders and are used in shot-guns which require low operating pressure and low resistance. The powders are prepared in granular form suitable for easy loading into the cartridge. The term bulk powder is often used in connection with shot-gun powders and derives from the time when black powder, which is still used to some extent, was the standard shot-gun powder. The standard charge of gunpowder was 3 drams, and the charge was measured by volume in a container designed to give this weight of charge. When smokeless powders were introduced they were designed to occupy at the required weights the standard volume of the 3-dram black powder measure. Thus, a 33-grain powder is one in which 33 grains, the charge necessary for standard ballistics, occupies the volume of the standard black powder measure. The difference in the rate of burning of powder of any one class is broadly determined by the amount of inert material used in the make-up of the powders.

(2) Gelatinised nitrocellulose powders in which the fibrous structure of the N/C is to a considerable extent destroyed by gelatinising with a solvent for the N/C. The dough-like mix resulting is extruded through suitable dies and cut to the required granulation, and the volatile solvent removed by stoving or steeping in water. These powders are often made porous by the incorporation of soluble salts which are subsequently leached out by water. The effect is to increase the effective burning area and produce a powder giving a fast rate of gas production. Revolver powders and powder for .22 rimfire ammunition are gelatinised porous powders based on N/C.

(3) Gelatinised nitrocellulose-nitroglycerine powders, in which the N/C is gelatinised by the high energy explosive nitroglycerine, are similar to military cordites. The so-called "express" sporting rifles used loads of this nature.

Double base powders are rendered porous in the same way as the gelatinised single base powders.

The gelatinisation of nitrocellulose by nitroglycerine can be brought about by heat and pressure alone; for example, by working on hot rolls, without the aid of volatile solvent. The sheets so obtained can be coiled and extruded from hydraulic presses, under conditions of vacuum pressing to exclude air, through suitable dies. This is often essential in producing the large sizes of propellant required for power cartridges. These are not for use in firearms at all, where the time of operation is measured in thousandths of a second, but are specially designed for applications of gas pressure in the engineering field involving much longer times of operation, from tenths of a second to 2 minutes. Such cartridges and charges are used for propelling military rockets, assisting take-off of aircraft, starting aeroplane or other engines, lowering aeroplane undercarriages, etc. In fully gelatinised propellants of this type, burning takes place from the surface in parallel layers. For the longer burning times, the so-called "wrapped cordite charge" is used in which all but one end of a cordite rod is protected by a relatively incombustible tape wrapping, so that the cordite burns from one end only like a cigarette. In this way the factor controlling the burning time becomes the length of the cordite stick instead of its diameter, and the burning time is limited only by restrictions on the size of the apparatus used.

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Explosives Law. A new Act concerning explosives was passed in England in 1860, and amended in 1861 and 1862, repealing all previous Acts. In 1875 a new Explosives Act was passed dealing comprehensively with the whole question. This was based on the report of the house of commons committee appointed to inquire into the terrible explosion on the Regent's Canal in 1874. and still

governs the whole question. Part I deals with gunpowder, which may be manufactured only in licensed factories and kept in licensed magazines under specified conditions. Part II deals similarly with nitroglycerine, and other high explosives; Part III with inspection, accidents, search, etc.; and Part IV gives supplementary provisions. Regulations concerning the use of explosives for blasting in Great Britain are laid down in the above Act, the Quarries Act of 1894, the Coal Mines Act of 1911, and the Mining Industry Act of 1920. The term explosive may include any substance deemed to be specially dangerous to life. Because many of the newer explosives are of a poisonous nature, regulations can also be made to safeguard the health of workers. Most other countries have introduced similar legislation. The Merchant Shipping Act of 1894 regulates the carrying of explosives in British vessels.

Exponent (Lat. *ex*, from, out; *ponere*, to place). Symbol of an algebraic expression denoting the number of times the expression is to be multiplied by itself. Thus in the expression a^3 , the figure 3 is the exponent of a , and the expression is equivalent to $a \times a \times a$.

Exponential. A term used in mathematics. The exponential function is the inverse of the logarithm: thus if $y = \log x$, then x is said to be the exponential of y . See Logarithms.

Exports (Lat. *ex*, from, out; *portare*, to carry). Commodities sent to foreign countries in the course of trade. In the U.K. exports are valued at a figure that includes all charges up to the point at which they are on board the exporting ship, while imports are valued at a figure that includes, in addition, insurance and freight. Before a true comparison can be made between total exports and total imports, the relevant costs of insurance and freight must therefore be added to the recorded value of exports. Current practice takes into account other financial factors not normally recorded in the trade figures. This makes it possible to calculate a periodical balance of payments, which is more important than the mere balance of exports and imports.

United Kingdom exports are classified by the Board of Trade thus: food, drink, and tobacco; raw materials; manufactured articles; parcel post. In the first class the chief exports are beverages, fish, sugar; in the second,

coal; in the third, pottery, iron and steel goods, machinery, vehicles, chemicals, textiles. The chief customers for exports of the U.K. are India, Australia, the U.S.A., Canada, Argentina, and the U.S.S.R.

In measuring increases and decreases in the total value of exports from year to year, differences in the purchasing power of money must be taken into account. A total of £393 millions in 1945, when corrected for price changes, becomes only £214 millions at 1938 prices, in which year exports were valued at £471 millions—a much less favourable ratio.

Since 1913 the normal course of international trade has been completely interrupted by the impact of war, and like other countries the U.K. suffered a decline in exports. She became for the first time a debtor nation and had to raise foreign loans; coal, hitherto her great export, was partly superseded by oil and electrical energy; and countries that had for centuries taken her manufactures were now providing their own. By developing her vast resources the U.S.A. became a formidable rival. Despite these difficulties, the conclusion of the Second Great War saw the core of British export trade still sound; taking the 1938 volume as 100, the volume of exports in 1946 was 99.3 and in 1948 was 136.3. The end of the war saw also the beginning of attempts at international regulation of trade by conventions, e.g. at Bretton Woods (*q.v.*). See Invisible Exports.

Exposition (Lat. *exponere*, to set forth). In music, the placing out or setting forth of the themes and materials upon which a piece is constructed. In fugue the exposition includes the first entries of all the voices or parts. In sonata form it includes the first presentation of the chief themes, before their development or elaboration is entered upon. See Fugue; Sonata.

Exposure. In photography, the amount of light passed by a lens; or, in photographic contact printing, the amount of light, passed by the negative, which is allowed to influence the sensitive material. It is usually expressed as a period of time, subject to known factors of type and intensity of light. For any particular sensitive material and standard development conditions a curve may be plotted to show the relative increase of density or blackening with increasing exposure. This is known as the characteristic

curve of the emulsion, in question. Correct exposure is that which confines the range of densities in the subject to the straight line portion of the curve.

The factors affecting exposure may be divided into those values capable of reasonably accurate measurement and those difficult to assess. The first class includes (1) the speed of the sensitive material in use for a certain type of light; (2) the aperture of the lens; (3) the effective speed of the shutter; (4) such factors as geographical latitude, period of year, and time of day. The second class includes (1) the actual intensity of light falling upon the subject; (2) the light reflected—this latter is governed by the type of subject.

EXPOSURE METER, or Calculator. This estimates correct exposure. It may take one of many forms. Calculators take into consideration all the factors of the first class enumerated above and any modification due to use of filters; but the actual brightness of light and type of subject are left to individual judgement. Actinometers improve on this by seeking to measure the brightness of the light falling upon the subject. In the Bee and Wynne meters this is ascertained by noting the time required for a piece of specially sensitised paper to darken to the same density as a permanent tint placed alongside it. Visual extinction meters measure the amount of light reflected from the subject by inspection of a series of figures or letters, light on a dark ground, of decreasing densities in a darkened chamber provided with an eye-piece at one end and directed towards the subject. Photo-electric exposure meters measure the intensity of the light falling upon or reflected from the subject by purely physical means, containing a sensitive cell which, when light falls upon it, generates an electric current of a magnitude proportionate to the intensity of the light.

No type of exposure meter will give entirely accurate results under all conditions; intelligent judgement must be exercised in relation to the type of subject. Even the photo-electric system derives light for its reading almost entirely from the highlights, and it is the relative depth of the shadows, of which the meter takes no account, which is the final determining factor.

Express System. Name for a special delivery service for letters and parcels provided by the general post office in the U.K.

Letters and parcels that are conspicuously marked "express" above the address may be handed over the counter at post offices that deliver telegrams, whence they will be taken to their destination by a telegraph messenger. The charge is 6d. a mile, with a surcharge of 1d. on each separate letter or packet after the first. Live animals, liquids, or money can be delivered by the service. The delivery also applies to letters transmitted by post and delivered by special messenger; the charge is 6d. additional to ordinary postage. Special delivery is also made of messages telephoned to a post office; the charge is 6d. a mile.

Expression, FACIAL. Outward indication on the features of the inward character or emotions. Sir Charles Bell first put the matter on a scientific basis in his essay on the Anatomy of Expression in Painting, 1806. Continental writers followed, but the classic work on the subject is Darwin's Expression of the Emotions in Man and Animals, 1872, in which are set forth physiological reasons for the variety of expression of which human faces, and in a lesser degree the faces of animals, are capable.

Darwin maintains that some human expressions, such as the bristling of the hair under the influence of extreme terror, or the uncovering of the teeth under that of furious rage, can be understood only on the assumption that man once existed in a much lower and animal-like condition. He thinks the movement of the same facial muscles during laughter by man and by various monkeys indicates descent from a common ancestor. See Acting, illus.

Expressionism. Art movement. As applied to the drama of ideas, expressionism was concerned chiefly with the unfamiliar in subject matter. It enlarged the scope of drama, the basic principle being that no human experience is outside the range of dramatic treatment. Such 19th century dramatists as Strindberg and Ibsen were the precursors of the movement, though Strindberg wrote many years before the term had been introduced by German critics. In his Spook Sonata, The Dance of Death, and The Father, types rather than individuals dominate the scene. In Germany, Kaiser's Gas, and Toller's Man and the Masses, were distinguished examples of expressionistic symbolism. These plays influenced a whole school of later writers in the experimental theatre of the 1920s

and 1930s. Pirandello's Six Characters in Search of an Author (one of the most original contributions to expressionistic drama), Capek's R.U.R., O'Casey's The Silver Tassie, Auden's and Isherwood's The Dog Beneath the Skin, Priestley's Johnson over Jordan, all depend for their effect upon unfamiliarity of treatment.

In painting, abstract expressionism developed in Germany shortly before and after the First Great War. Evolved in 1908 by Kokoschka in Vienna and Pechstein in Berlin, a crude form of expressionism, as yet uninfluenced by the Cubists, served as a reaction against impressionism. In Great Britain, France, and the U.S.A., this movement was termed post-impressionism (*q.v.*). The influence of Cézanne, Gauguin, and van Gogh was at first predominant, but expressionism later adopted a semi-cubist manner as exemplified in the work of Franz Marc, *i.e.* forms based on architecture and three-dimensional geometry. The Russians Kandinsky and Javlenky gave impetus to the German painters. Klee, whose preoccupation with pattern and colour represented a more subtle form, influenced younger schools of painters. An attempt was made by later expressionists to return to more naturalistic forms, this development receiving an impulse from the naïve-realistic manner of Henri Rousseau.

Express Rifle. Name given to a heavy sporting rifle introduced in 1856 and since developed into a number of types used for big game, especially elephant hunting. Express rifles vary in calibre from 0.303 in. to 1.052 ins. The weight of the barrel varies from 6 to 16.5 lb., and the length from 22 ins. to 30 ins. The range varies between 250–500 yds. Certain types of express rifle are double-barrelled.

Extended Order. A military formation in which the ranks and files of troops on parade are separated by a distance of two paces. The term is also applied to troops advancing to the attack and dispersed over as wide an area as possible so that they will not offer an easy target.

Extension. Term used in engineering for the stretching of materials under tension. Every material stretches under a pull, though the amount may be relatively small. A bar of wrought iron one inch square will stretch only one twelve-thousandth of an inch with a pull of a ton upon it. Heat causes expansion, but this

should not be confused with extension in engineering. Within the elastic limit of the material the strain is directly proportional to the stress which produces it. The strain is defined as the ratio of the extension to the original length of the bar. The ratio of the stress to the strain is an important constant for any solid and is called the modulus of elasticity of the material. If a solid is stretched beyond its elastic limit it does not return to its original length.

Extensometer. An instrument used in engineering and metallurgical design. It is often necessary to measure accurately the minute elastic extension of materials, in order to forecast their behaviour during usage. On a steel test piece two inches long this may be less than 0.003 inches, so very delicate measuring instruments must be used, of which the extensometer is one.

Extent. In law, a writ of execution to recover crown debts. The extent in chief was issued by the crown against the body, lands, goods, or other property of the debtor. The extent in aid was issued by a crown debtor against his own debtor so that he might be able to pay his debt to the crown. These writs are rare at the present day.

Extenuating Circumstances. Term used in English law. A jury may add a rider to a verdict of guilty that there were extenuating circumstances in favour of the prisoner. The judge may take this into account in the sentence, except in cases of murder and high treason, when he is bound to pass the capital sentence. In France, "Guilty with extenuating circumstances" is a different verdict from guilty; and the sentence is different.

Extortion (Lat. *ex*, out; *torquere*, to twist). In English law, a demand by an official, or someone else performing a public service, of money in excess of the amount due, or of money not yet due. It is applied by an extension to the act of obtaining money by means of threats, the offence known as blackmail. Extortion in the strict sense is punishable by fine and imprisonment, a number of statutes having forbidden it. Other forms may become robbery and be punished as such.

Extract (Lat. *extractus*, drawn out). Term applied, in chemistry and pharmaceuticals, to products obtained by treating any substance with solvents and then evaporating

the latter. In a more restricted sense, an extract is a concentrated form of a vegetable drug. It contains the active part of the drug, the inert portion, consisting of woody fibre, being exhausted of its active principles during the process of extraction.

The various operations involved in extraction have received special names. Infusion is the process of allowing a drug to remain in contact with hot or cold water for definite periods of time; if the solvent is boiled during the period the process is decoction. In another common method, known as percolation, the comminuted drug is placed in a conical vessel and the solvent slowly passed through it. To reduce the liquid to a more concentrated form it is evaporated by heat. The extracts prepared in pharmacy are either thick liquids or soft pastes. The pastes are used as ingredients in making pills and lozenges.

Extradition (Lat. *ex*, out; *traditio*, handing over). Term used in law for the surrender, by one state to another, of fugitive criminals. As between the states, this depends on treaty; no state has an inherent right, apart from express agreement, to claim extraditory rights from another. Treaties for extradition now exist between most civilized states, but political criminals are invariably excepted from their operation. The manner in which extradition is applied for and granted depends upon the law of the country where the fugitive is. In England it is governed by the Extradition Acts, 1870-1935, which apply in relation to foreign countries, and the Fugitive Offenders Act, 1881, which applies within the British Empire.

By these Acts, a fugitive offender is not to be surrendered unless the foreign state concerned undertakes to try him only on the charge on which he is extradited. The fugitive is to be brought before a magistrate, who must be satisfied that the alleged offence is not political, and is one of the crimes for which extradition can be claimed. These offences range from murder to bribery. If the magistrate decides that the case is made out, he commits the alleged offender to prison, and then a secretary of state makes an order for the gaoler to hand him over to the representative of the foreign state. See International Law.

Extragalactic Nebulae. Systems consisting of thousands of millions of stars held together by

their mutual gravitational attractions but entirely separate from and in no way connected with the Milky Way. It is estimated that there are many millions of these objects within the reach of the biggest telescopes, and, together with the Galaxy, which is probably fairly typical of them, they constitute the whole known universe. See Nebula.

Extra-Mural Education. Literally, education "outside the walls." The term is applied to all activities of a university which aim at extending directly its teaching and influence among those members of the community who would not otherwise have the advantage of contact with university teachers or experience of a course of study of university type. After centuries in which Oxford and Cambridge were as indifferent to the intellectual condition of the masses as these were ignorant of the universities, during the second half of the 19th century a great change took place. Scientific discoveries, the spread of the ability to read, the awakening of the public conscience by Shaftesbury, Ruskin, Jowett, T. H. Green, etc., induced in some of the finest scholars of Oxford and Cambridge the desire to propagate culture. In 1871 the religious tests were abolished which had hitherto kept dissenters out of Oxford and Cambridge. In 1872 the university extension movement began, providing courses of evening lectures of university standard for working men and women, principally on non-technical subjects. Eventually such lectures were arranged in most large towns and even in villages, their success probably helping much to stimulate the establishment of the provincial universities.

But university extension classes affected only those among the working class already converted to the value of education. They left the masses untouched. University settlements were begun in London, first at Toynbee Hall in 1884, and then in Camberwell, Bermondsey, Bethnal Green, etc.; subsequently in other cities. Today every university in Great Britain and some in America have settlements or missions which link academic work in practical fashion to the social problems of the time. Some of the best known politicians, clergymen, lawyers, and authors served apprenticeship in a university settlement. In 1903 the Workers' Educational Association (*q.v.*) was founded by

Albert Mansbridge, and it has cooperated with the universities in extramural education.

Extraterritoriality. A term used in international law. It describes the status of a person who, when in foreign territory, is immune from the jurisdiction of local laws and courts. Sovereigns and diplomatic agents are considered such persons by ancient usage. If a sovereign is abroad, his house is extraterritorial; and the official residence of an ambassador is, by courtesy, part of the country which he represents. Hence no arrest can be made there under a local warrant; nor is the house assessable to rates and taxes. Sometimes by treaty all the subjects of one state residing in another are made extraterritorial for purposes of justice. A ship of war in a foreign harbour, behaving peacefully, remains a part of the country whose flag she flies; and a military force in a foreign country is not subject to the laws of that country except by agreement; *e.g.* the British army in France during the First Great War was subject not to French but to English military law, and during the Second Great War reciprocal arrangements were made, *e.g.* in respect of American forces in Great Britain and British forces in the U.S.A. The system whereby extraterritoriality was granted to European subjects in Eastern countries has been brought to an end. In China extraterritorial rights were relinquished by treaties negotiated in 1943-44.

Extravasation (Lat. *extra*, outside, beyond; *vas*, vessel). Outpouring of fluid into the tissues from an injured vessel. The most familiar example is the extravasation of blood which may follow a blow on the skin resulting in the formation of a bruise.

Extreme Unction OR SACRAMENT OF THE DYING. Fifth of the seven sacraments of the Roman Catholic Church. It was instituted for the spiritual and bodily comfort of those *in extremis*. Recognized also in the Greek, Coptic, Armenian, and Nestorian Churches, with varying ceremonial, and dating from the 12th century, it is regarded as authorised by James 5, vv. 14-15, and is administered by the priest, who anoints the dying person.

Unction is usually applied to the seat of each of the five senses, with prayer, *e.g.* "Through this holy unction, and His most tender mercy, may the Lord pardon thee whatever sins thou has committed

by seeing. Amen." With the other senses the necessary word is used in place of "seeing." In Roman usage the oil is applied in the form of a cross, after reception of the Viaticum or Holy Communion. In the Church of England the rite was abolished in 1552. *See* Sacrament.

Extrovert. Psychological term used by Jung. It and its opposite, introvert, denote the two types of temperament into which he divided the human race. The extrovert is interested in external reality and adapts himself to it; the introvert is interested in his own personality, needs, etc., and tries by day-dreaming, wishful thinking, and similar devices to adjust reality to himself. The distinction is of little scientific value since (a) most human beings fall between the two types, and (b) the reactions themselves are not fundamental traits, but depend upon whether the environment is pleasant, terrifying, etc. *Consult* Psychological Types, C. G. Jung, 1923.

Extrusion. Process used in the fabrication of glass, plastics, viscose, and metals into rods, channels, threads, and wires. In metals, a billet is heated until pliable; for aluminium and its alloys 300-400° C. would suffice, for brasses about 800° C. While still hot it is placed in a preheated container in a press, which is operated either mechanically or hydraulically, in either of two ways. In the direct process, the fixed end of the container carries a die, shaped to form the extruded cross-section desired; the other end is a pad, only slightly smaller than the inside of the container in diameter, and behind the pad is a ram. When pressure is applied to the ram the pliable material is forced through the die, and so shaped. The inverted process employs a moving die in place of the ram and

pad, the die being forced into the billet which remains stationary in the container. Tube may be extruded by piercing the billet with a plunger before extrusion and then using the plunger as a mandrel. Very high pressures are employed and 1,000-ton hydraulic presses are common. *See* Glass; Plastics; Silk, Artificial.

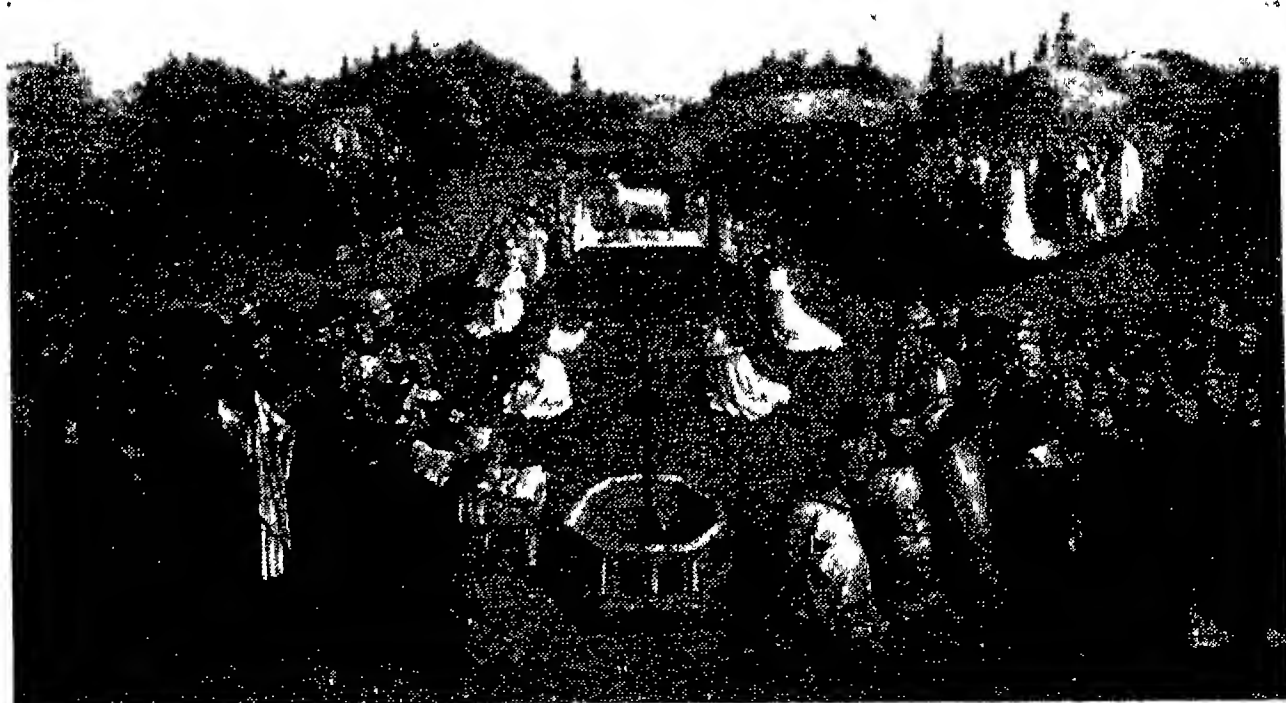
Exuma, GREAT. Island of the Bahamas, British West Indies. It is S.E. of Andros I. and W. of Long I., about 30 m. long by about 7 m. wide. The chief settlement is Georgetown. Pop. (1953) 2,919. Near is an islet called Little Exuma.

Eyam. Parish and village of Derbyshire, England. It stands in Eyam Dale, 5 m. N. of Bakewell. In the churchyard is a Runic cross, and there are several barrows, one of which, on Eyam Edge, is more than 100 ft. in diameter. During the plague of 1665-66 the inhabitants voluntarily cut themselves off from the outside world and most of them perished. Pop. (1951) parish, 951. *Pron.* eem.

Eyck, HUBERT VAN (c. 1366-1426). Flemish painter. He was born at Maeseyck, in the prov. of Limburg. Before settling at Ghent as court painter, early in the 15th cent., he spent some time in N. Italy. He probably began, and his brother Jan certainly completed the altar-piece of The Adoration of the Lamb, executed for the cathedral of S. Bavon at Ghent, where he died, Sept. 18, 1426. Certain panels sold in 1816 and long in German possession were reunited and restored to Belgium under the



Hubert van Eyck,
Flemish painter
From an old print



Eyck. The Adoration of the Lamb, the central panel of the altar-piece at the cathedral of S. Bavon, Ghent, the masterpiece of the van Eyck brothers



Jan van Eyck's famous picture,
Jan Arnolfini and his wife
National Gallery, London

treaty of Versailles. Few authentic works by Hubert are known. There were some in Berlin and one each in Paris, Madrid, and Copenhagen.

Both painters rank among the greatest of the Flemish school. Their drawing and finish were meticulously exact, their colouring is almost as fresh and brilliant as it was 500 years ago, and they so improved the method of oil painting that they made it virtually a new medium. They were not, however, as sometimes alleged, its discoverers. A 10th century MS. by the monk Eraclius (*De Coloribus et Artibus Romanorum*) states that a method of grinding colours with oil was then "in the air," and Rogierus, a monk of the

12th century, recommended that colours should be ground with oil and mixed. The nature of the improvement introduced by the van Eycks seems to have been regarded as a craft secret, but it was conjectured that it was some essential oil which yielded a clear, transparent, liquid vehicle; retained its limpidity; dried without darkening; and, mixed with colours, gave results so superior as to supersede the viscous varnishes formerly in vogue. Consult H. and J. van Eyck, W. Weale, 1908; The Van Eyck Problem, M. Brockwell, 1954. Pron. ike.

Eyck, JAN VAN (c. 1385-1440). Flemish painter, brother of Hubert. Born at Maeseyck, he appears to have resided in

The Hague during 1422-24, at Bruges for a few months in 1425, in which year he went to Lille, where he remained for four years, and later visited various foreign countries in an official capacity as painter to fulfil state commissions. He died at Bruges July 9, 1440. He is represented at his best in the National Gallery, London, by the magnificent picture of Jan Arnolfini and his Wife, and at the Louvre by the exquisite Chancellor Rollin Kneeling before the Virgin. Margaret (c. 1377-1430), his sister, was also an excellent painter.



Jan van Eyck,
Flemish painter
From an old print

are called ommatidia. Each has its own lens system, and a crystalline rod which seems to concentrate light on a sensitive cell. The ommatidia are optically isolated from each other by pigment. In many kinds of arthropods there are also simpler eyes, apparently derived from the in-pushings still found in their cousins the worms.

In molluscs the eyes are also fundamentally in-pushings, and in the most highly evolved forms, such as the cuttle fish, these eyes may be very complicated and are, it would seem, very effective.

All these eyes are always connected to the nervous system by nerve fibres. Light is nearly always concentrated on the faces of the sensitive cells of the in-turned skin which transmit, by these nerve fibres, the changes resulting in them from being subjected to light.

In the vertebrates, however, the eyes are essentially a part of the central nervous system itself which has been brought near to the surface, and to which have been added other elements co-operating in the formation of a functional whole. Their development through the whole of the vertebrate series is very similar. The central nervous system of the vertebrate, such as man, is a hollow tube made of ectoderm (*q.v.*), of which the bore varies at different points along its length. Near the front end, in the embryo, there is a considerable enlargement called the 3rd ventricle, and on each side, from the bottoms of the walls of this chamber, there is pushed out, by growth, a hollow diverticulum whose inside is continuously in communication with the space of the 3rd ventricle. This outgrowth is called the optic stalk. It is simply a part of the wall and floor of the brain which has grown fast and therefore got pushed out. As it grows, the advancing front end, that is the end farthest from the brain, enlarges. This, again, is by growth—the front end grows faster than the rest of the optic stalk, and the

EYE: THE ORGAN OF VISION

Paul G. 'Espinasse, Prof. of Zoology, University Coll., Hull,
and D. Stenhouse Stewart, M.R.C.S., D.O.M.S.

An explanation of how the eye, particularly in human beings, develops with the development of the embryo, and of how it perceives light and images. See also: Light; Optics; Vision, etc.; and for disabilities and diseases such headings as Astigmatism; Blindness; Conjunctivitis; Glaucoma; Myopia; Orthoptics; Sight; Spectacles, etc.

Protoplasm, the material of which living things are made, is commonly affected by light in ways which show themselves in a change in the behaviour of the living thing. In the more advanced forms, this capacity to react to light, while by no means restricted to any area, is much greater in one kind of organ—the eye—than it is over the rest of the body.

In the invertebrates there are eyes of many different kinds. They are always developed from the outer skin which may fold in and become transparent over the fold. In the arthropods, and in

particular in the insects, a most elaborate eye has evolved, having a considerable degree of efficiency. In it the optical elements are separate, so that the animal receives, apparently, a picture reminiscent of a photograph reproduced by printing from a half-tone block. It must consist of dots of light or shade, according to whether that part of the image falling upon any particular isolated optical element in the eye is light or dark. This is quite unlike any other eye, and must presumably have been evolved quite independently. The optical elements



Eye. Compound eyes of the housefly, highly magnified

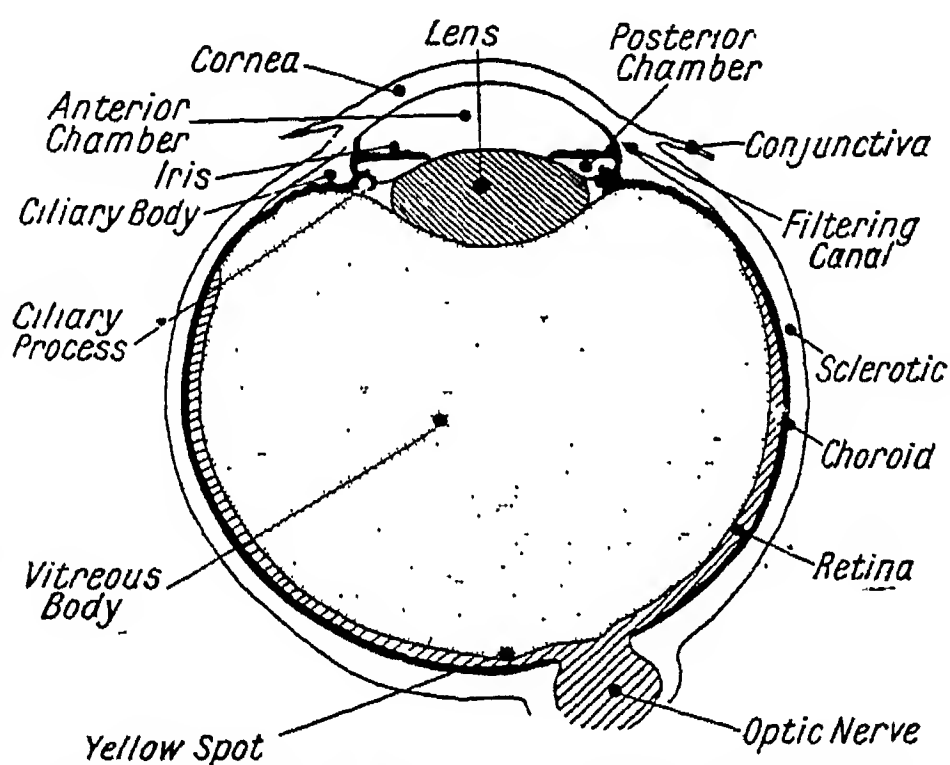
dorsal part of this front end grows even faster than the ventral. This enlarged end is called the optic vesicle. The optic stalk starts by being roughly circular in section. This does not last: it becomes indented by a longitudinal groove which folds in along its ventral surface. The front of the optic vesicle gets pushed in by a forward extension of this groove. When the front has been pushed in the structure is called the optic cup, and it looks, from its front, like a cup with one crack in it, the embryonic fissure, or choroid fissure. This optic cup has a double wall. The space between the outer and inner walls is still in communication with the cavity of the 3rd ventricle.

At this stage of the development of the embryo the whole of the central nervous system is receiving upon its surface a condensation of loose mesodermal tissue. This condensation, or skin, is called the pia mater, and that part of it which condenses on the developing eye is called the choroid layer. From the first this choroid layer is applied to the whole of the surface of the structure under consideration; this includes the inner surface of the optic cup, simply because this was formed by the pushing in of the optic vesicle. In all this choroid layer blood vessels develop, as, indeed, they do in the rest of the pia mater. From these vessels is provided the vascular system of the eye, in both outer and inner layers.

Many of the cells forming the inner of these two layers of the optic cup (destined to form the light-sensitive retina in the adult) proliferate, and some grow tails which run back to the floor of the 3rd ventricle, these tails all growing towards the top of the embryonic or choroid fissure and then burrowing their way back to the brain in the material making up the roof of the groove in the optic stalk. When these tails reach the brain they make contact with other cells which have stayed in the brain. Together, these tails make up the adult optic nerve. They are very numerous indeed,

and a transverse section of them all together makes an immensely larger picture than a transverse section of the original optic stalk, in the floor of which they really begin to run.

The blood vessels in that part of the pia mater or choroid layer which is applied to the inner, or retinal, layer grow in an organized way so that they become oriented as elements radiating also from the top of the embryonic, or choroid, fissure. They are supplied and drained by larger vessels running in the pia mater along the groove. The inner aspect of the optic cup will now show vessels and nerve fibres all running to and from the top of the fissure. The lower part of this fissure closes, by the apposition of its sides, leaving a hole at its top. This hole is



Eye. Sectional diagram of the human eyeball, seen from above, showing the positions of the various structures which receive and transmit visual impressions

filled up by all the vessels and nerves which have therefore to run through it. It is the one part of the inner aspect of the back of the eye which does not have light-sensitive elements in it. It remains blind, and is called the blind spot, or optic disk, and from it radiate in the adult eye all the arteries and on it converge the veins and nerve fibres which enter into the structure of the complicated adult retina.

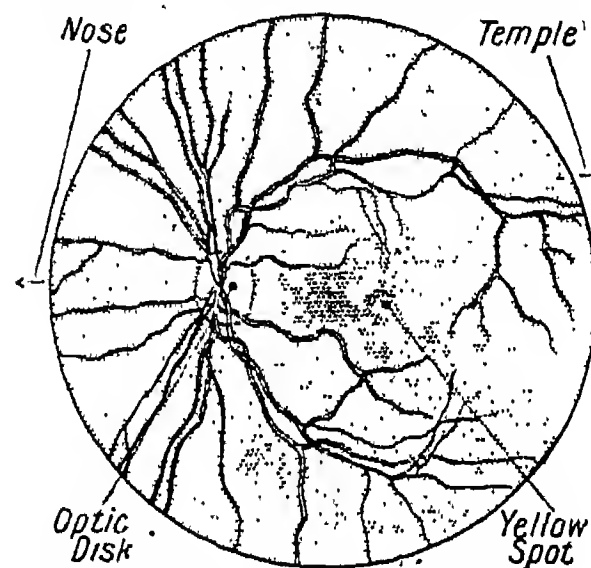
During the processes described the growing optic cup has been closely approaching the outside skin of the embryo. The sink immediately overlying the optic cup develops a small hollow in-pushing. This in-pushing heals, and closes off a hollow spherical bubble of ectoderm which is contributed to the eye. Its hollow is filled by growth of the cells of the back wall, and it forms the transparent lens of the eye surrounded by a capsule of mesoderm. From the front cells

transparent fibres grow backwards and forwards within the capsule, enveloping and compressing the central core or nucleus, the transparency of which may diminish in advanced age. The transparent fibres may also lose their transparency, so that vision may be impaired to a greater or less extent. Any such condition is known as cataract, and, if so opaque as to warrant it, the lens can be removed from within the capsule, and the optical properties of the whole system restored by special spectacles. A second, lesser, operation is sometimes necessary to ensure a clear opening in the capsule that remains. Alternatively, the whole lens can be removed, capsule and all. This is a difficult operation; but if it is successful the cure is complete.

After the lens has been contributed to the developing eye, a space appears in the mesoderm between the lens and the now completely healed skin. This space becomes the aqueous chamber of the eye. It is wholly lined with mesoderm, and becomes filled with fluid, called the aqueous humour.

Everything so far described as entering into the formation of the eye is now involved in a second condensation of mesoderm which, like the first, envelops the whole central nervous system. This second condensation is called the dura mater, and it forms a tough membrane. The white and rather opaque part which envelops most of the growing eye is called the sclerotic; the part overlying the aqueous chamber is transparent and is called the cornea.

The skin once more produces over the developing eye an in-pushing. This remains outside the developing sclera, and is therefore never a part of the true eye at all. It spreads, and separates the lids from the eyeball. This cavity is lined with conjunctiva, a layer of skin (ectoderm with

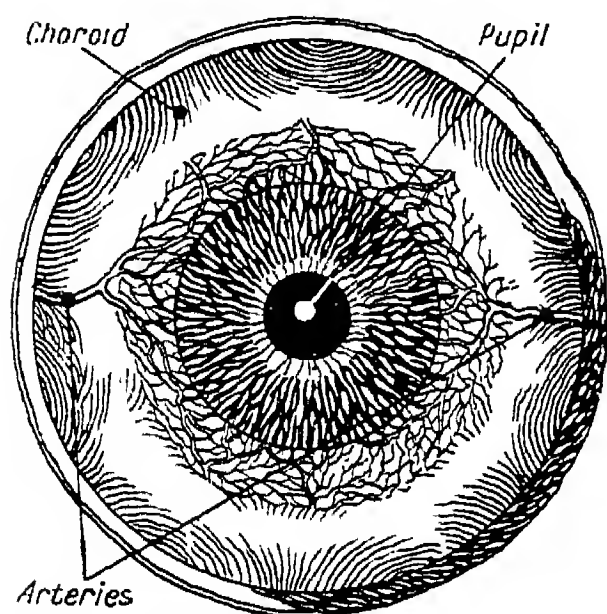


Eye. Diagram of the retina showing position of optic disk

underlying mesoderm with blood vessels) which is translucent and which thins out to overlie the transparent cornea.

The lens, caught between the front of the optic cup and the back of the aqueous chamber, gets attached to the front of the optic cup by a complicated system of fibres and muscles called the zonule and ciliary body. By the outward pull of these on its equator the lens, which has so far been roughly spherical in form, is made flatter. Vitreous humour fills the chamber behind the lens. If the lens of the human eye at rest is correctly flattened, an image of any distant object in the field of vision is focused accurately on the retina by the compound optical system set up by the cornea, the aqueous humour, the lens, and this vitreous humour. This whole system is kept in shape by the slight pressure of its contents. If this pressure should rise seriously, a condition known as glaucoma (*g.v.*) results. When anything near is looked at, the muscles of the ciliary body contract, allowing the young elastic lens to bulge, and to move a little forward so that the near object can be focused. This elasticity is lost with advancing years. If the eye grows too flattened the image will be focused in front of the retina, and the person with such an eye will be short-sighted.

After the lens of the embryo is in position, the rim of the optic cup, two layers thick, grows over the front of it, forming, with its mesodermal covering, the iris.



Eye. Behind the cornea, the transparent coat of the front of the eye, are the coloured, contractable iris and the pupil, through which light passes

This growth presently stops, leaving a round hole, the pupil, which can be contracted or dilated by muscular action. Thus is controlled the amount of light which enters the eye. The pupil is large in dull light and small in bright.

Except in albinos, who cannot make melanic pigment at all, the outer layer of the optic cup becomes heavily pigmented, to ensure that light enters the eye only through the pupil. In brown- or black-eyed people there is pigmentation in the front mesodermal layer of the iris. In blue-eyed people there is little or no pigment in the front layer of the iris, but the back layer is pigmented as usual.

Action of Light

The light-proof back of the eye is made up of the outer layer of the optic cup, black with melanic pigment, the sclera, and that part of the original pia mater or choroid trapped between them. The inner layer of the optic cup forms the highly complex retina, and the whole of the rest of the eye is an arrangement to bring light properly focused on to this retina, for it is here that the light is used. The pigmented epithelium is the inside of the outer layer, and the receptor layer is the outside of the inner layer. Between them is the obliterated cavity of the original optic stalk which was in communication with the 3rd ventricle of the brain. In a pathological condition the retina sometimes gets detached from the pigment layer. This is really the reopening of the old cavity.

The light-sensitive elements are of two kinds: rods, very sensitive to light, but probably not sensitive to differences in colour; and cones, which are rather less sensitive to light, but are probably sensitive to differences in colour. It is a remarkable fact that light has to go through all the vessels and connective tissue and nerve fibres shown there before it gets to the actual light-sensitive elements. This is quite unlike the condition in nearly all invertebrates, where the light falls on the faces of the sensitive cells.

The exact way in which the light brings about a change in the sensitive cells is not quite clear. It can be said, however, that a substance called visual purple (in no way to be confused with the melanic black backing pigment of the outer layer, from which it is wholly distinct in every way) is bleached by light. This substance is present in and among the sensitive cells, and there is some evidence that it mediates the chemical change which starts the propagation of a wave of change along the nerve fibres to the brain. When these impulses reach the brain they are sorted out and

perceived by a mechanism of which we know very little.

Rods and cones are not distributed equally all over the surface of the retina. At the blind spot there are neither. At a point near the middle of the back of the eye there are far more cones than rods. It is on this point that the image of the eye of a needle is focused when it is threaded, or of a colour when it is matched. Round the edge of the retina there are only rods, and it is here that faint stars are seen most easily. When trying to pick out a faint light at night it is best not to look straight at it. This keeps the image off the cones in the middle of the eye and on the rods. For the same reason, an electric light which is really flickering on alternating or interrupted current can often be seen to be doing so when its image is at the edge of the retina.

Appreciation of Colour

The details of the perception of colour are not understood. It is remarkable that part of the mechanism which seems to mediate it is present in animals which are certainly colour-blind. The eyes of most, if not all, mammals seem to contain cones which are thought to respond differently to different wavelengths of light, but for these differences to be perceived seems to require a further elaboration not of the eye but of the brain, which is present only in man and a very few other mammals and birds. Some insects certainly distinguish colours, but how they do it is not known.

In the vertebrates as a whole, there is a connexion between the optic nerves leading from the two eyes before they actually reach the brain. Rather more than half the fibres from the right eye reach the left side of the brain. The meeting of the two nerves gives a very obvious X-shaped structure called the optic chiasma, underneath the brain. In some way this arrangement permits the fusion of the two fields of vision of the two eyes into one percept.

The eyes lie in two cavities or sockets in the skull, known as orbits. This arrangement protects the eyes, for the bony margins of the orbits resist blows which would otherwise damage the eyeball. The eyelids and lashes also protect the eyes, and the lachrymal gland, which secretes tears and is situated at the outer side of the eye, is another protective device. The eyes are moved by six muscles each. A disturbance of the balance of these muscles in an adult

may cause headache or even double vision; in a child it causes a squint requiring immediate attention. If other means fail, the squint can often be corrected by surgery. *Consult* The Invertebrata, L. A. Borradaile, L. E. S. Eastham, F. A. Potts, and J. T. Saunders, 1932; General Zoology of the Invertebrates, G. S. Carter, 1940; The Vertebrate Eye, G. L. Walls, 1942.

Eye. Small hole, or loop, in certain articles, usually in a seam through which a cord or tape can be threaded to close the article. Eyebolts are screw bolts with a ring in them. The eyes of a sail are holes which take the lashings when reefing. A Flemish eye is the end of a rope bent to form a loop.

Eye. Mun. bor. and market town of Suffolk, England. It stands on an affluent of the river Waveney, 19 m. N. of Ipswich, on the railway. An ancient town, it has castle ruins, a grammar school founded in 1566, a town hall, and corn exchange. Brewing is an industry. Market day, Mon. It gives its name to a co. constituency. Pop. (1951) 1,631.

Eyebars. Metal bar with one or both ends enlarged. In the enlarged end a hole is drilled so that by means of a pin or bolt the end of the bar may be secured to another object. Eyebars vary in size, from a fraction of an inch in diameter up to the great eyebars used in the Quebec bridge, each sustaining a pull of 300 tons.

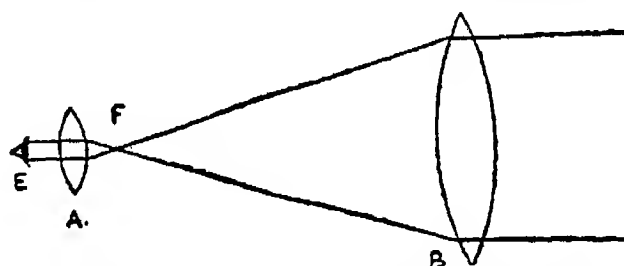
Eyebolt. A bolt with one end formed like an eye or rigid ring instead of an ordinary head. Eyebolts are used for many purposes, e.g. as door fastenings and attachments for stays and guys.

Eyebright (*Euphrasia officinalis*). Small annual herb of the family Scrophulariaceae. A native of N. Europe, N. and W. Asia, and N. America, it is a parasite upon the roots of grasses, sedges, etc. The leaves are oval or lance-shaped, with cut edges, the flowers small, white, veined with purple, and the middle lobe of the lip yellow. It grows in meadows and on heaths.

Eyemouth. Burgh of Berwickshire, Scotland. It stands at the mouth of the little river Eye, 8 m. N.W. of Berwick, and has a railway station. Eyemouth is a fishing centre, for

which industry there is a good harbour, protected on the N. by St. Abb's Head. The town hall is the chief building. Pop. (1951) 2,269.

Eye-piece. Lens of a telescope nearest to the eye. In a telescope light falls in nearly parallel rays on the object lens, which throws an image of the field of vision. The eye-piece magnifies this image. Eye-pieces used with astronomical telescopes vary in form. The first telescope made by Galileo had a bi-concave eye-piece such as opera glasses now have. This eye-piece is placed between the object glass and the focus at which the image is thrown. Convex eye-pieces are placed outside the focus. But both kinds colour the light coming from the image owing to



Eye-piece. Diagram showing principle of working. E, eye; A, eye-piece; F, focus; B, object lens

the refraction of the rays. Huygens discovered that this defect might be remedied in the eye-piece by employing two plano-convex lenses, both with the flat sides towards the eye, the larger placed nearer the image, and the smaller nearer the eye. This construction is in general use, except for micrometer eye-pieces, which have spider-webs for measuring the sizes of the different objects. In these eye-pieces the flat sides are turned away from each other.

Eylau OR PRÜSSISCH-EYLAU (Russ. Bagrationovsk). Town of Kaliningrad region (the northern part of former E. Prussia), R.S.F.S.R. It stands on the Pamar, 24 m. S. of Kaliningrad (Königsberg), and is noted for the battle fought here, Feb. 8, 1807, between the French under Napoleon, and the combined Russians and Prussians.

After his defeat at Pultusk, Dec. 26, 1806, Bennigsen, pursued by Napoleon, decided to make a stand at Eylau. In an engagement on Feb. 7, 1807, Bagration and Barclay de Tolly, after several assaults by the French, were forced to abandon the village. In a snowstorm on the morning of the 8th the battle

developed. The emperor could bring into the field only Augereau's and Soult's corps, together with six divisions of Murat's cavalry; his other troops were hurrying up over snow-bound roads. An advance by the French from Eylau was beaten back and the Russians attacked in force against Eylau windmill. Augereau's 7th corps was thereupon ordered by Napoleon to stem the Russian advance. The day was going against the French, and the battle reached a crisis when Augereau's troops, blinded with driving sleet and snow, enfiladed by artillery and attacked by infantry, suddenly had a mass of cavalry launched against them. Augereau was hit, and all his colonels and brigadiers were killed or wounded.

The French broke, and were in full flight when Napoleon hurled 18,000 of Murat's cavalry upon the Russians. The effect was decisive. The Russians were scattered, regiments were ridden down in the blinding snow, the squares were broken, 16 standards were taken, and the victorious French stopped only on encountering Bennigsen's reserves. As the afternoon wore on, with the arrival of Napoleon's reserves, the day was won, and Bennigsen retired on Königsberg, having lost 18,000 men and 24 guns. The French lost 15,000 men out of 79,000; the Russians numbered 75,000. In the Second Great War Prussisch-Eylau was captured by the Russians, Feb. 10, 1945. It has machine building plants. *Pron.* ile-ow.

DEUTSCH-EYLAU (Pol. Ilawa) lies 68 m. S.E. of Danzig (Gdansk) in the Polish region of Olsztyn (Masuria). In the Second Great War it was captured by the Russians Jan. 22, 1945.

Eyot (A.S. *igath*) OR Arr. Islet in river or lake, especially one overgrown with willows. *Pron.* eight.

Eyra. S. American wild cat. Resembling a large weasel with a long tail, it is reddish brown in colour, without stripes. It ranges from Mexico to Brazil, and is a trouble to the poultry farmer.

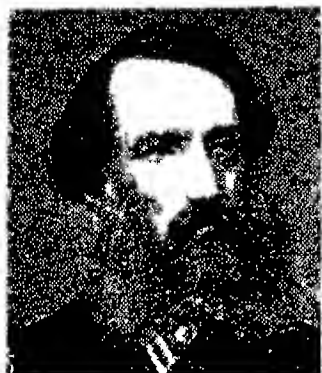
Eyre. Word derived from the Latin *iter*, a journey. It is used chiefly in connexion with the itinerant justices sent out by Henry II and known as justices in eyre. In Scotland the form *aire* was used.

Eyre. Lake in S. Australia. It is 3,000 sq. m. in area, full in 1950 for the first time since its discovery in 1840 by E. J. Eyre (q.v.). In dry seasons, it is merely a salt marsh; in wet, the Borecoo and Diamantine flow into it.



Eyebright. Flowers and leaves of *Euphrasia officinalis*

Eyre, EDWARD JOHN (1815-1901). British colonial governor. Born at Hornsea, Yorks, Aug. 5, 1815, he emigrated to Australia in 1833, and carried out valuable explorations of unknown territory, especially of the coast between Adelaide and King George Sound, in 1841. He went to New Zealand as governor in 1846, to St. Vincent, 1854, and to Jamaica, 1861. His



Edward J. Eyre,
British explorer

stern handling of the negro rising there in 1865 caused his recall to England, where his action roused wide controversy. In 1872 the government repaid the legal expenses which he had in self-defence incurred, and awarded him a pension, 1874. He died Nov. 30, 1901.

Eyre, SIR JAMES (1734-99). English lawyer. Born at Wells, he went from Winchester to S. John's College, Oxford, and became a barrister. He successfully defended John Wilkes in 1763, attacking general search warrants, by which means Wilkes's authorship of No. 45 of the North Briton had been proved. From his post as recorder of London he was promoted in 1772 to be a judge; in 1787 he became chief baron of the exchequer and in 1793 chief justice of the court of common pleas. He remained in office until his death, July 1, 1799.

Eyre, SIR VINCENT (1811-81). British soldier. The son of a soldier, he was born Jan. 22, 1811, and educated at Norwich grammar school. He joined the service of the E. India Co. in 1828 and, in the artillery, was with the force that entered Afghanistan in 1840; after the siege of Kabul by the Afghans he and his family were surrendered to them as hostages. In 1843 they were rescued by a relieving force. Eyre commanded the artillery at Gwalior, and during the Mutiny distinguished himself by his prompt action in marching against some rebels at Arrah and defeating them at Jagdespur. He held a command in the force that relieved Lucknow, and retired as a major-general in 1863. He died at Aix-les-Bains, Sept. 22, 1881.

Eyston, GEORGE EDWARD THOMAS (b. 1897). British racing motorist. Born June 28, 1897, he went to Stonyhurst and Trinity College, Cambridge. Equally interested in designing and driving cars, between 1931 and 1938 he captured some 250 records for speed

by distance or time. In 1936 with A. Denly he broke every record from 500 m. to 5,000 m. and from 3 hr. to 48 hrs. He excelled Sir M. Campbell by driving his car Thunderbolt at 311.42 m.p.h., Nov. 19, 1937; and on Sept. 16, 1938, in Utah, attained 357.53 m.p.h. Eyston, who was awarded



G. E. T. Eyston,
British racing
motorist

the Segrave trophy in 1935, edited *Fastest on Earth*, 1939. He was engaged in the Second Great War on naval constructional engineering. *Pron.* Easton.

Ezekiel, BOOK OF. One of the prophetic books of the O.T. Ezekiel was both priest and prophet. With King Jehoiachim and other members of the upper classes of Jerusalem he was deported to Babylonia in 597 B.C. by Nebuchadnezzar (605-562 B.C.). The exiles were settled at different points, Ezekiel becoming a member of the community at Tel-abib, near the river Chebar, which has been identified with the grand canal in the neighbourhood of Nippur. The prophet received his call in the fifth year of the reign of Jehoiachim (592 B.C.).

The book falls into five divisions: (a) the prophet's call and consecration, Ezek. 1, v. 1-3, v. 15; (b) discourses on the imminent destruction of Jerusalem, 3, v. 16-24, v. 27; (c) oracles against Ammon, Moab, Edom, Philistia, Tyre, Sidon, and Egypt, 25-32; (d) prophecies of the restoration of Israel and the overthrow of her foes, 33-39; (e) vision of a restored theocracy of a united Israel, 40-48. The book itself assigns definite dates to many of the prophecies, the latest mentioned being about 570 B.C. Once the prophet admits that a prediction had not been fulfilled, when Nebuchadnezzar was expected to capture Tyre.

The authorship and integrity of the book present no difficulty. The difficulties are associated with the Hebrew text, often obscure and corrupt. As the author was a priest it is not surprising to find that he lays more stress than the other great prophets on externalities, rites, and ceremonies. We find points of affinity with the priestly phraseology of the later legislation, which has been called the Code of Holiness (Lev. 17-26). But due emphasis is laid also upon personal responsibility and personal re-



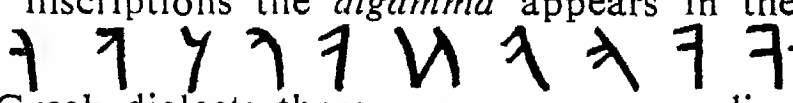
ligion. "Pastor rather than prophet," Ezekiel's visions of the chariot and cherubim (1, v. 1-3, v. 15) had influence on the later symbolical literature. They have been interpreted (e.g., by the Rabbis) as a synopsis of theosophy. The vision of the valley of dry bones in chap. 37 has become famous. In chaps. 38 and 39 occur the curious creations Gog and Magog (q.v.).

Ezion-Geber. Port at the head of the Gulf of Akaba, built by King Solomon as a base for vessels trading down the Red Sea to Ophir (1 Kings 10). The site may be at or near Eilat; in the vicinity, at Tell el Kheleifa, American archaeologists in 1938 found a smelting plant.

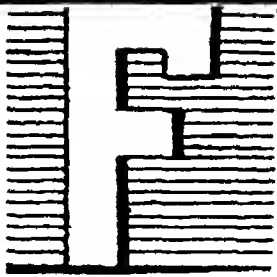
Ezra, BOOK OF. Book of the O.T. Ezra was a Jewish scribe living in exile in Babylon, under Artaxerxes Longimanus. He is said to have belonged to the priestly line, and to have been a descendant of Seraiah, the high priest when Jerusalem was captured by Nebuchadnezzar. About 458 B.C. he was allowed to return to Jerusalem. There he found that the remaining Jews had intermarried with heathen women, and great laxity prevailed, and he set out to restore worship and order. He started the rebuilding of the Temple, and restored the text of the Jewish law.

The O.T. Book of Ezra is closely related to the Book of Nehemiah, so closely indeed that, as the Talmud and early Christian writers indicate, they form really one work. Closely related to them are the Books of Chronicles, of which Ezra and Nehemiah are a continuation. The threefold work, Chronicles-Ezra-Nehemiah, covers the history of Israel from the period of Adam to the second visit of Nehemiah to Jerusalem in 432 B.C.; but the history is viewed from an ecclesiastical and priestly standpoint.

Ezra-Nehemiah (which together appear in the Septuagint as 2 Esdras) includes the history from 538 B.C., when Cyrus issued a decree permitting Jewish exiles to return, to 432 B.C., when Nehemiah made his second visit to Jerusalem. The Ezra portion records the return of the exiles, the rebuilding of the temple, and the mission of Ezra, who was sent as royal commissioner from Babylonia to Jerusalem by Artaxerxes. Part of the book is written in Aramaic (4, 8-6, 18, and 7, 12-26). Ezra-Nehemiah seems to have been compiled between 300 and 250 B.C.

F, THE sixth character of the English alphabet, corresponds to the sixth letter of the North-Semitic alphabet, , which had the phonetic value of v-w, and was called *waw*. A secondary form of this letter became the Greek *digamma*, this name being given on account of its external likeness to a double gamma . It has the sound of a consonantal u, akin to English w. In inscriptions the *digamma* appears in the forms . In some Greek dialects there was no corresponding sound and the letter was discarded, but it survived in others till it was gradually discontinued in classical times, the sign being retained to represent the numeral 6.

The Etruscan alphabet contained the *digamma* with its phonetic value v-w; the sound f was then expressed by the combination w-h,



and f came to represent the sound f. Thus the North-Semitic *waw* and the Greek *digamma* came to represent the Latin sound f (the Greek *upsilon* having been adopted to represent both the consonant v and the vowel u). The Latin F descended into the majority of modern alphabets.

The elongated minuscule *f* came into use because early scribes joined it to the preceding and following letter when writing at speed. Some surnames, e.g. ffoulkes, fforde, ffrench, are the result of a practice among certain medieval writers of representing a capital letter by doubling the minuscule.

F Sixth letter of the English and Latin alphabets. It is a voiceless labial (lip-sound), the corresponding voiced sound being v. Its ordinary sound is as in *fat*. In the single word *of*, and in its compounds, e.g. *hereof*, *thereof*, it is pronounced as v. A noun ending in -f often takes plural in -ves; *loaf*, *loaves*. Doubling f modifies the sound of the preceding vowel; *chafing*, *chaffing*. The sound f is also represented by *ph* in words derived from the Greek, e.g. *philosophy*.

F. In music, the fourth note of the natural scale of C. F is only a semitone above E. F sharp is the first sharp to appear in a key signature—key of G.

Faber, FREDERICK WILLIAM (1814–63). British divine. Born at Calverley, Yorks, June 28, 1814, he



F. W. Faber

was educated at Balliol College, Oxford, and in 1843 became rector of Elton, Hunts. In 1845 he seceded to the Roman Church and in 1854 became the first superior of the Oratory of S. Philip Neri at Brompton. A popular preacher, he is best known by his hymns, which include *Sweet Saviour, bless us ere we go*; *Hark, hark, my soul*. He died at Brompton, Sept. 26, 1863.

Faber, SIR GEOFFREY CUST (b. 1889). British publisher and writer. Born Aug. 23, 1889, he was educated at Rugby and Christ Church, Oxford, and worked with the Oxford University Press, 1913–14. After the First Great War he became a barrister, and from 1924 was chairman of a publishing firm.

He was knighted 1954. His works included *Oxford Apostles*, 1933; *A Publisher Speaking*, 1934; *The Buried Stream* (poems), 1941.

Fabia. One of the oldest Roman *gentes* or clans, probably of Sabine origin. They appear to have been originally priests, who took part in the supervision of the festival Lupercalia (*q.v.*). They were a patrician clan, whose chief families were those of Ambustus, Labeo, Maximus, and Pictor.

Fabian Society. The oldest British Socialist organization. Founded in 1884, it was named after the Roman general Fabius Maximus (*v.i.*) whose tactics were expressed thus: "For the right moment you must wait . . . but when the time comes you must strike hard." It numbers over 5,000 members and has 100 local societies. Since the days when Sidney and Beatrice Webb and Bernard Shaw were leading members the society has always exerted political influence, and it was one of the founder organizations of the Labour party, with which it is officially connected. It seeks to encourage Socialists in a high standard of free and independent research. The offices are at 11, Dartmouth Street, Westminster, London, S.W.1.

Fabius Maximus, QUINTUS (d. 203 B.C.). Roman general. He was appointed, with dictatorial powers, to the command of the Roman forces after the defeat by the Carthaginians at Lake Trasimenus, 217 B.C. By a series of delaying tactics—whence his surname of Cunctator (the delayer)—Fabius avoided pitched battles with Hannibal, wore down the offensive power of the Carthaginians, and gave the Romans time to consolidate their forces. He thus

paved the way for Scipio's victories, which ended the Second Punic War. Fabian tactics have come to be used proverbially for a waiting policy.

Fabius Pictor, GAIUS. Painter of a battle scene c. 302 B.C., on the walls of the temple of Salus (Safety) in ancient Rome: the first recorded Roman painting. In the reign of Claudius both temple and picture were destroyed by fire.

Fabius Pictor, QUINTUS (c. 225 B.C.). Earliest Roman historian. Except for some fragments, his writings, which were in Greek, are lost: but he was one of the authorities used by Livy, Diodorus Siculus, and Polybius. A Latin version was also in existence.

Fable (Lat. *fabula*, story, narrative). Short allegorical story in which generally animals, trees, etc., are endowed with speech and human qualities, and by their words and deeds are made to convey moral lessons. Its invention is frequently ascribed to Aesop, but many fables associated with his name probably originated at a much earlier date in India, where they are known sometimes as the fables of Bidpai or Pilpay, a traditional ancient Indian philosopher, and sometimes as the work of Buddha. Some of the fables traditionally ascribed to Aesop are but variants of those found on ancient Egyptian papyri. Many, too, have been traced to the Arabs.

It is probable that tales of a fabulist character are common to most primitive peoples, mark, indeed, a definite stage in culture; the addition of a "moral" to any beast tale being a natural development, and not peculiar to one originating writer or people. Of later fabulists La Fontaine is perhaps the most celebrated.

Fabliaux. Short tales in verse, almost always octosyllabic couplets, dealing from the comic point of view with incidents of ordinary life. The fabliaux appeared in France in the 12th century, and remained popular for about 200 years. The tales are licentious both in subject and in treatment, frequently satirising priests or women or both in language that is generally coarse, but many of them have real humour and the best are free from objection. The fabliaux were first collected and published by Barbazan in the 18th century, and were re-collected and issued in six volumes by Anatole de Montaiglon and Gaston Raynaud in 1872-90.

Fabre, FERDINAND (1827-98). French novelist. Born at Bédarieux, Hérault, Feb. 9, 1827, he studied for the priesthood, medicine, and the law in turn before producing his first novel, *Les Courbezons*, 1862. He died in Paris, Feb. 11, 1898. A moderate realist, he depicted with minute fidelity the people and manners of the Cévennes, as in *Le Chevrier*, and excelled particularly in studies of clerical life, as in *L'Abbé Tigrane*, 1873, and *Mon Oncle Célestin*, 1881.

Fabre, JEAN HENRI (1823-1915). A French entomologist. Born at St. Léons, Aveyron, Dec.



Jean H. Fabre,
French entomologist

21, 1823, he passed early years in great poverty. At 18 he was in charge of a primary school, where he improved his knowledge of mathematics and physics in his spare time, and where he bought his first book on entomology. Becoming professor of philosophy in the college of Ajaccio and in 1852 at the lycée at Avignon, he turned his attention to the study of insects. His earliest observations appeared in the *Annales des Sciences Naturelles*, 1855-58, subsequently enlarged in *Souvenirs Entomologiques*, 10 vols., 2nd ed. 1914, etc. He died Oct. 11, 1915.

Fabre's earlier volumes are remarkable for their close and painstaking observations on living insects, bringing to light many unsuspected habits and instincts of wasps and bees in particular. His work, though gaining the praise of Darwin, failed to win popular attention. But the reputation of the insect's Homer, as Fabre has

been called, has steadily increased. A curious blend of Gilbert White and Darwin, he not only displays amazing powers of minute and careful observation, but his writings have an unusually high literary quality. *Consult* Works, complete Eng. trans. A. Teixeira de Mattos, 1912, etc.

Fabre d'Eglantine, PHILIPPE FRANÇOIS NAZAIRE (1750-94). A French revolutionary and dramatist. Born at Carcassonne, July 28, 1750, he became a member of the National Convention and for a time was secretary to Danton. He had been an actor, and his play *Philinte* attracted some attention in 1790, but perhaps his most successful literary achievement was the renaming of the months for the revolutionary calendar, 1793. He was guillotined with Danton and his friends on a false charge of forgery, April 5, 1794.

Fabriano. City of Italy, in the prov. of Ancona. It stands on the E. slopes of the Apennines, at an alt. of over 1,000 ft., 45 m. by rly. S.W. of Ancona, and is the rly. junction for Urbino. It has a cathedral and town hall, and some of the churches contain pictures of the Fabriano school. The city is celebrated for its paper mills, established in the 13th century. Gunpowder, glue, parchment, and felt are also made, and there is trade in cattle and cereals. The hospital of Jesus and bishop's palace were damaged in the Second Great War. Pop. (1951) 27,553.

Fabric (Lat. *fabrica*, workshop). Term meaning originally cloth made by weaving or felting, but by extension applied also to the material of which anything is made. The linen, treated with "dope" or other preservative, long used for the outer covering of aircraft fuselage and wings, was called fabric. The word is also applied to the outer body of a building, or figuratively to any system of united parts, e.g. a national constitution, human society, or a religious denomination.

Fabricius, GERONIMO (1537-1619). Italian anatomist. Known as Fabricius ab Acquapendente, he succeeded Fallopius in 1562 as professor of surgery and anatomy at Padua, where his great knowledge of comparative anatomy enabled him to introduce improvements into applied surgery. His *Opera Chirurgica*, 1617, was widely read. One of the founders of embryology and an excellent anatomist, he discovered the valves in the veins, and so led William Harvey, who studied under him, to

consider the circulation of the blood. Fabricius died May 21, 1619.

Fabricius, JOHANN ALBERT (1668-1736). A German classical scholar. Born at Leipzig, Nov. 11, 1668, at the age of 25 he removed to Hamburg, where shortly after publishing his *Bibliotheca Latina*, 1697, he became a professor at the gymnasium. His later works on classical bibliography, storehouses of learning and still indispensable, included *Bibliotheca Graeca*, 1705-28; *Bibliotheca Ecclesiastica*, 1718; and *Bibliotheca Latina Mediae et Infimae Aetatis*, 1734. He died at Hamburg, April 30, 1736. *Pron.* Fab-ree-ts-ioos.

Fabricius Luscinus, GAIUS (fl. 280 B.C.). Roman general. He won notable victories over the Lucanians, Bruttians, and Samnites, and in the war with Pyrrhus twice conducted negotiations with that monarch. After the Roman defeat at Heraclea in 280 B.C. Pyrrhus tried hard to buy Fabricius over, but the stern Roman was incorruptible. Later, after Fabricius had delivered up a traitor who had offered to poison Pyrrhus, negotiations were resumed, with the result that in 278 satisfactory terms of peace were arranged. During his censorship in 275 he made great efforts to check the growing tendency to luxury and extravagance. He himself died so poor that his daughters had to be provided with dowries by the state. Fabricius was lauded by subsequent generations as the embodiment of the old republican virtues. *Pron.* Fab-rish-ius.

Fabritius, CAREL (c. 1624-54). Dutch painter. A pupil of Rembrandt, he lived in Delft. Little is known of his life, and his pictures were few. His *Portrait of a Man*, in the Rotterdam museum, was for long attributed to Rembrandt. His most famous work, *The Goldfinch*, was in the Mauritshuis at The Hague, though *The Family Group*, destroyed by fire, was accounted his masterpiece. There were several portraits by him in German galleries, and one of a soldier in the National Gallery, London. His most famous pupil was Vermeer (*q.v.*) on whom his influence is apparent. Fabritius perished in a powder magazine explosion at Delft, Oct. 12, 1654.

Fabrizi, NICOLA (1804-85). An Italian patriot. Born at Modena, April 4, 1804, he was implicated in the Carbonari insurrection of 1831. He fled to Marseilles and thence to Spain, where he fought against the Carlists, 1837. One of Mazzini's

most trusted agents, he moved to Malta, whence he assisted the Sicilian insurrection of 1848. When revolution broke out in Italy, he fought at Venice and Rome, retiring to Malta after the fall of Rome. He raised a revolt in Sicily in 1860 and joined forces at Palermo with Garibaldi, who made him governor of Messina and war minister. He opposed Garibaldi's Rome campaign of 1862, but in 1867 fought at Mentana. He died March 31, 1885. *Pron.* Fab-reet-si.

Fabroni, ANGELO (1732-1803). Italian biographer, called "the Plutarch of modern Italy." Born at Marradi, Tuscany, Sept. 25, 1732, he became prior of San Lorenzo, Florence, in 1767, and was appointed tutor to the sons of Leopold, grand duke of Tuscany, in 1773. His chief work was *Vitae Italorum Doctrina Excellentium qui Saeculis XVII et XVIII floruerunt*, in 20 vols., 1778-1805, vol. 19 containing his autobiography. He also wrote biographies of Lorenzo de' Medici, 1784; Cosimo de' Medici, 1788-89; and Petrarch, 1799. He died Sept. 22, 1803.

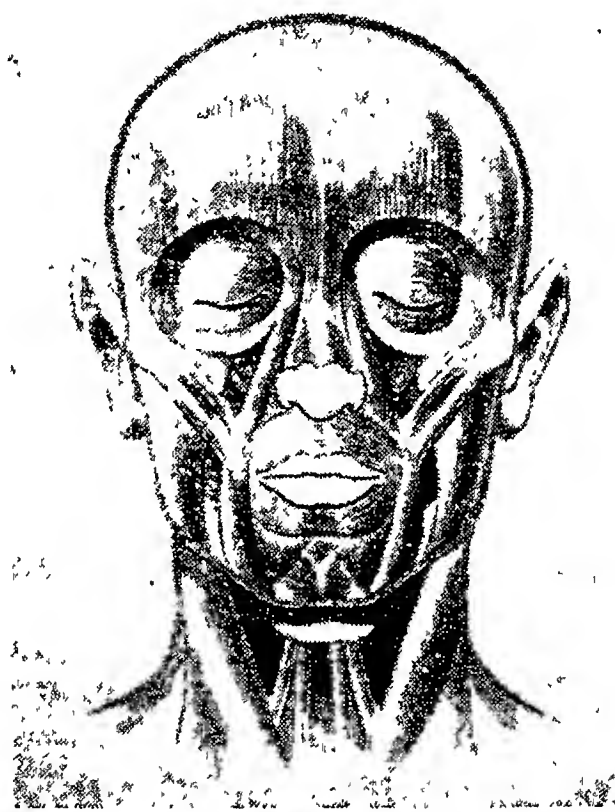
Façade (Fr.). Architectural front of any building or part of a building. Not necessarily confined to the principal front, the term is mostly used in connexion with street architecture, where one face of the building is mainly important. A façade is, strictly, a front in one plane. Thus a front with one or more pavilions projecting from its surface could not be referred to as a single façade, each pavilion having its own façade. *See* Architecture.

Face. The front of the head. The face may be divided into the regions of the forehead, temples, ears, eyes, nose, mouth, cheeks, and upper and lower jaws. The bones of the face are fourteen in number, twelve being in pairs, namely the superior maxillary, malar, nasal, palate, lachrymal, and inferior turbinated bones. The palate bone is situated deeply in the region of the mouth and nose. The mandible or lower jaw and the vomer, part of the septum dividing the nose into two parts, are single bones.

Besides these bones, some of the bones assigned by anatomists to the cranium also take part in the formation of the face, namely the frontal, parietal, sphenoid, and temporal bones. The forehead is formed by the frontal bone. Underlying the scalp is the frontalis muscle, contraction of which causes the furrows which appear on the forehead when the brows are lifted to express surprise. Running up

on each side of the forehead is the temporal artery which is often prominent and well marked, owing to thickening of the walls of the vessel, an indication of senility of the vessels. The superciliary ridges are bony prominences above the eyes, best seen in adult males. These ridges were strongly developed in certain prehistoric forms of man, particularly Neanderthal man. Vertical furrows seen in the act of frowning are produced by a small muscle, the *corrugator supercilii*.

The eyeball is situated in a bony framework known as the orbit, which, together with the projection of the nose, serves to pro-



Face. Diagram showing the muscles of expression in the human face

tect it from injury. The aperture between the eyelids is known as the palpebral fissure. The nose is divided into two parts by a septum formed partly of bone and partly of cartilage, the junction of the two being marked by the bridge of the nose. The outer angle of the orbit is prolonged towards the ear into a bridge of bone known as the zygoma. The temporal muscle occupies a fossa forming the greater part of the temporal region, its tendon passing beneath the zygoma to be attached to the lower jaw. This muscle takes part in the act of mastication, and can be felt contracting when the mouth is firmly closed. The anatomical features of the ear, nose, and mouth are described under their respective headings.

The principal nerves of the face are the fifth or trigeminal nerve, which is the main sensory supply to the face, and the seventh or facial nerve, which supplies most of the muscles of the face. The

face is well supplied with blood-vessels, which explains the profuseness of haemorrhage following injury to the tissues.

Face Conveyor. Machine used for the transport of coal. The transport of coal from the point where it is cut out of the working face comprises three stages—from the face to the main haulage way; the main haulage to the foot of the shaft; the raising of the coal to the surface. The first stage is relatively costly, and often difficult on account of the limited space available, and particularly the low roof. Face conveyors have been introduced to perform it.

The jiggging conveyor consists of a long steel trough suspended on short arms in such a way that the trough can be "jiggged" to and fro. Coal is shovelled on to the trough, and at each stroke or movement is thrown or jerked bodily forward a short distance until finally thrown off the end of the conveyor. The chain conveyor consists of a fixed trough or bed along which a chain is drawn. The chain is composed of bars of steel, forming links and cross-pieces all of which have their faces vertical. The coal is thrown on to the chain, the large pieces being carried along on the tops of the links and cross-pieces, while the small drop through the chain to the bottom of the trough, and are scraped forward by the under edges of the chain. These machines can be moved forward as the working face is extended. Driven either by compressed air or electrically, one can remove 360 tons from a face of 100 yards in eight hours. *See* Conveyor.

Face Value. Nominal value of debentures, stocks, shares, and securities generally, as opposed to their real or market value. For instance, the face value of Consols is in £100 and multiples of £100, and of an ordinary share in the Amalgamated Press 10s., although in each case the selling value is very different.

Fâcheux, LES (The Bores). Three-act or comedy-ballet masque by Molière. Written and played within a fortnight, it was first produced in the garden of Fouquet's residence, Vaux-le-Vicomte, Aug. 17, 1661. It displays ten bores, satirical portraits from society, who prevent an ardent young lover from speaking with the object of his devotion. It was the first play written by Molière for Louis XIV, and the first play of its kind to be produced on the French stage.

Facial Angle. A method of measuring the facial profile, especially in man and the anthropoid apes. The earliest, Pieter Camper's (c. 1770), was subtended by two lines (1) drawn from the glabella to the upper jaw, (2) drawn in a plane passing through the



Facial Angle. Diagram showing a method of measuring the facial profile

base of the nose and the centre of the aural orifice. This measures 40° (orang-utan), 70° (negro), 80° (European). Camper's angle is now superseded.

Facial Nerve. Seventh cranial nerve. It supplies most of the muscles of the face, and the sense of taste in the anterior part of the tongue. Paralysis of the facial nerve (Bell's Palsy) is most often due to inflammation of the fibrous tissue surrounding the nerve where it leaves a narrow canal bone, the nerve thus strangulating itself. It is most commonly caused by exposure to cold. At sudden onset the face is drawn over to the opposite side, while on the affected side the eye cannot be closed, the lower lip drops, and the forehead cannot be wrinkled. Within a time limit of 2 days to 2 years the recovery from paralysis begins, and recovery is usually complete. Salicylates and iodides are useful drugs, while galvanic stimulation helps the tone of the inactivated muscles. Eventually the surgeon may have to relieve the nerve of the constricting pressure.

Facility (Lat. *facilis*, easy). Ability to perform anything easily. In Scots law it has a special meaning: a condition of mental weakness that falls short of idiocy. The person suffering from this condition is one easily persuaded.

Factor (Lat. *maker*). In mathematics, any of two or more numbers or expressions which when multiplied together produce a given number or expression. Thus 7, 3, 2 are factors of 42 and $(a+b)$, $(a-b)$ of a^2-b^2 . A factor which can be divided only by itself and unity is called a prime factor. The

factor of the greatest degree which is common to two algebraic expressions is called the highest common factor. In arithmetic the highest number which is a factor of two or more numbers is called the greatest common divisor.

Factor (Lat. *facere*, to make). Word meaning an agent, but in a special sense an agent who buys and sells for a principal. He carries on business in his own name, but differs from a broker in that he usually handles the goods in which he deals and transfers them to his principal; moreover, he has a greater latitude about buying and selling. In English law several statutes have regulated the relations between a factor and his employer, these having been consolidated by the Factors Act of 1889. Much, however, is left to custom, and this differs obviously very much between one trade and another. The main provision of the Act gives a valid title to a person who in good faith buys from a factor goods which are in the factor's possession with the consent of his principal.

Factor in Scotland is a man who manages an estate, a land agent. A judicial factor is one appointed by a court of law to manage the estate of a minor or imbecile.

Factor of Safety. Ratio of the ultimate strength of a structure, or part of a structure, to the normal load which it carries under the conditions for which it was designed. Where accident may involve injury to human beings, a high factor of safety is usually prescribed by law. The wire rope used for winding men in pit cages must have a factor of safety of from 8 to 10, i.e. the rope must be strong enough to carry 8 to 10 times the normal load.

Factory. Building or assembly of buildings devoted to the manufacture of goods. Factories are defined by the Factories Act, 1937, as any premises in which persons are employed in manual labour in any process for or incidental to (a) the making of any article or part of an article; (b) the altering, repairing, ornamenting, finishing, cleaning, washing, or breaking up or demolition of any article; or (c) the adapting for sale of any article. This definition abolishes the old distinction between textile factories, non-textile factories, and workshops. This Act (*v.i.*) is a complete code covering the safety, health, and welfare of all persons employed in factories as well as regulating the hours of employment of women and young persons.

In planning a factory the builder's first consideration is the site. In heavy industries proximity to raw materials may govern the choice, though this factor may be overborne by convenience of transport or access to markets. Coal being a prime necessity for most industries, the coalfield areas have in the past attracted a large proportion of works, but with the adoption of electric power this is not now such a great matter. The wide use of this power and the value of being near the chief market have caused a movement of British lighter industries into the neighbourhood of London. For chemical works, where salt, lime, or other deposits are prime necessities, it is cheaper to erect the buildings over these deposits even at the cost of transporting the coal.

The usual modern factory consists of a group of light, well ventilated, single-storey buildings, so constructed that they can be readily expanded or adapted. For some processes, e.g., flour milling, a multi-storeyed building may be the most economical. Proximity to railways, roads, and waterways is an obvious requirement. Other needs are firm foundations away from marshy ground or underground workings, and accessibility of workers, particularly those of traditional skill, as in the manufacture of cutlery, steel, and pottery. In old days, climate influenced choice of site; the cotton industry was favoured by the damp of Lancashire; but air control and air conditioning have made natural climate less important. The buildings are so designed that the flow of work is continuous from intake of raw material to outflow of finished goods. Internal transport of goods is reduced to a minimum and mechanised as far as possible. Lifting gear and labour-saving devices are profitable, e.g. belt conveyors, mechanised trucks, travelling cranes, and even light railways. The principle of mass production is to bring the work to the several workers and so break down the job that each worker is engaged on a small operation. The resulting monotony raises problems of the welfare of the worker.

Increased use of electricity as a motive power has increased the flexibility of lay-out, and has improved the appearance and safety of workshops by abolishing large driving belts and shafting; while the extension of the grid system throughout the U.K. has relieved many of the lighter

industries of the necessity of generating power on the premises.

Generous expenditure and vigilant economy are both required to ensure success. The best firms do not hesitate to put back into the business large capital expenditure on new machines, lay-out, and buildings. Much saving has been effected by the utilisation of waste and by-products. Scarcity of fuel during the Second Great War led to further economies by the use of warm water from steam condensation, of rubbish as a source of heat, and the lagging of furnaces and boilers. Coal tar, once thrown away in the process of preparing coal-gas but now of greater value than the gas itself, is the classic example of a by-product. Sheets of tinned iron scrap from tinplate factories, formerly discarded as useless, are now chemically stripped and the recovered tin is used again.

Division of Work

The work in a factory is technically divided into two classes: (a) the actual process of manufacture, and (b) the services which facilitate it. The latter, subsidiary branch comprises the supply of power, maintenance of buildings, repair of tools and machines, packing and labelling finished products, and the care of the workers. A typical factory includes most or all of the following departments:

(a) *Manufacture*: Receipt and storage of raw material; actual manufacture in successive stages; finishing and assembling; packing, labelling, and analysis; dispatch. (b) *Services*: Transport by road, rail, or water; power (including water services, light, heat, and motive force—hydraulic, steam, or electrical); engineers' shop and stores; social service (rest rooms, canteens, etc.); time-keeping; accountancy; store-keeping.

Each manufacturing department is restricted to a single phase of the complex process of converting raw material into finished product. To coordinate the output of all these independent parts, so that none is kept idle by any other, requires the closest care. It is upon fine adjustments and economies that the margin of profit often depends. Under the general control of departmental managers, a foreman is in charge of each workshop and responsible for its output.

The length of the working day or week that will scientifically give maximum output varies with the individual and with the industry, but the war years showed that excessive hours of work do not produce commensurate output.

An increase in the care given to the welfare of the workers is one of the social advances arising out of wartime experience. Many firms improved conditions after the First Great War, supplying rest rooms, medical supervision, first-aid rooms, canteens, and recreational facilities, with the help of voluntary societies.

Wilfrid Garrett

Factory Acts. In the United Kingdom, a series of over twenty statutes, aimed at regulating conditions in factories and workshops, especially on behalf of women and children. The first was passed in 1802, Addington's Act, "for the preservation of the health and morals" of apprentices, etc., employed in cotton and other factories; child employees were not allowed to work more than 12 hours a day nor later than 9 p.m., and had to be taught the three Rs in working hours.

The Act of 1833 barred the employment of children under nine years of age at factories and provided *inter alia* for an eight-hour day for children under 13, for certain holidays, and for factory inspectors. The 1844 Act initiated the following interpretations, viz. "young person," between 13 and 18 years old; child, under 13 years; it laid down that women were to be employed on the same conditions as to hours as young persons, who, together with children, were not to work on Saturdays after 4.30; and regulated the fencing of machinery. The 1847 Act set up an eleven-hour day maximum for factory workers and a ten-hour day for women and young persons, with a 58-hour maximum for the week.

Lord Ashley (earl of Shaftesbury) was perhaps the most prominent of the reformers of abuses which for years disfigured the industrial system in the 19th century. Other Factory Acts were passed at intervals to safeguard the workers further from accident, disease, or oppression, and to provide for the education of children employed at factories before national education was adopted.

The Factories Act, 1937, consolidated the law, incorporating and amending the provisions of the Factory and Workshop Act, 1901, and later Acts. It contains general provisions as to health, safety, and welfare: including, under health, cleanliness, overcrowding, temperature, ventilation, lighting, drainage, sanitary conveniences; under safety, prime movers, transmission, construction and sale of new machinery, vessels containing dan-

gerous liquids, cleaning of machinery by women and young persons, hoists, lifts, chains, ropes, cranes, construction of floors, passages, and stairs, safe means of access, safe place of employment, dangerous fumes, explosive or inflammable dust or vapour, fire escape and precautions; under welfare, drinking water, washing facilities, first aid, space for clothing.

Welfare and Health Provisions

The Act next sets out special provisions as to health, safety, and welfare applicable to certain industries and processes dealing with the removal of dust or fumes, meals in dangerous trades—e.g. where lead or arsenic is used—protection of eyes by goggles or screens where there is a risk of injury from particles or fragments, installation of hydrometers in humid factories, the prohibiting of artificial humidification in underground rooms, basements, bakehouses, and laundries, lifting excessive weights, employment of women and young persons in certain processes. There are rules for the notification and investigation of accidents and industrial diseases, and concerning home work and piece work.

An abstract of the Act must be posted at the principal entrances of a factory. The Act is reinforced by detailed regulations made by the Home secretary. Failure to observe it is a criminal offence.

Factory Inspector. Class of British civil servants attached to the ministry of Labour. The inspectors are responsible for the proper administration of the Factories Act. They may enter and inspect a factory at any reasonable hour of the day or night, and may require the production of registers, certificates, etc. It is an offence to obstruct an inspector.

Faculae (Lat. *facula*, small torch). Areas of the sun's surface hotter and therefore brighter than the remainder. Dark sunspots are nearly always surrounded by facular areas, but faculae may appear unaccompanied by spots. These often mark disturbed regions which have given or are about to give rise to sunspots. See Sun.

Faculties, COURT OF. Court held on behalf of the archbishop of Canterbury to deal with cases arising from the legatine powers of the archbishop, administered partly by him personally and partly by the master of the faculties. These powers are concerned with the granting of special and ordinary licences for marriage in both provinces, Canterbury and York; the issue of dispensations to hold

two benefices in plurality; conferring Lambeth degrees; and the appointment of notaries. When disputes arise an appeal lies to the court of faculties, presided over by the dean of the arches, who is also the judge of the court of arches, the provincial court of Canterbury. The registrar's address is 1, The Sanctuary, Westminster, S.W.1. See Ecclesiastical Courts.

Faculty (Lat. *facultas*, facility, ability). Any special mental power, e.g. the faculty of speech. This use of the word has come down from the early philosophers. Derived obviously therefrom is the use of the word for a department of a university, and for its instructors; thus in modern universities we have the faculties of arts, medicine, law, theology, science, etc. Similar is its occasional application to the members in a collective sense of a learned profession, e.g. the faculty of advocates in Scotland. In the U.S.A. the teaching staff of a university or college is called the faculty.

In English ecclesiastical law and usage the term means a permission to do something which is not allowed by the common law; e.g. to be married otherwise than after the publication of the banns, or to make an alteration in a church. For such matters as the altering of churches, putting up monuments, etc., therein, each bishop deposes his chancellor to hear the application. See Ecclesiastical Law.

Fadden, SIR ARTHUR WILLIAM (b. 1895). Australian politician. He was born April 13, 1895, and entered politics in 1936 when he was returned to the house of representatives as member for Darling Downs, Queensland. He became minister for air in Aug., 1940, and commonwealth treasurer soon afterwards. He succeeded R. G. Menzies as prime minister in a coalition govt. in Sept., 1941, but commanded no majority and resigned next month after a vote of censure on the budget. He then led the opposition until 1943, thereafter the Country party. Treasurer again in 1949, he was created K.C.M.G. 1951.

Fading. Term applied to the weakening of signal strength in radio reception. In medium and long wave transmissions the signal can travel to the receiver by two paths: the ground-ray comes direct, the sky-ray goes diagonally upwards and is reflected down again by the Heaviside layer (q.v.). Since these paths are of different lengths the waves may arrive in different phases and

interfere. Where the two rays are of much the same strength, and a trough in the one coincides with a crest in the other, they will cancel out and the signal fade. Since the effective height of the Heaviside layer depends on the radiation received from the sun, fading varies from day to night and from winter to summer, and shorter fluctuations (from 1/100 sec. to 15 min.) occur as a result of magnetic disturbances connected with sun spots. Fading in short wave transmissions is the result of interference between two or more sky-waves coming by different paths. Rapid fluctuations may wreck all long distance radio-communications during high sunspot activity.

Faed, THOMAS (1826-1900). A Scottish painter. Born at Gatehouse of Fleet, Kirkcudbrightshire, June 8, 1826, he studied art at Edinburgh, and painted many scenes of Scottish life, humorous and pathetic. A.R.S.A. in 1843, he came to London in 1852, and became A.R.A. in 1861, and R.A. in 1864. He died, Aug. 17, 1900, almost blind, at St. John's Wood. His *Faults on Both Sides*, *Silken Gown*, and *Young Highland Mother* are in the national collection, at the Tate Gallery.

Faenza (anc. Faventia). City of Italy, in the prov. of Ravenna. It stands on the Lamone, 31 m. by rly. S.E. of Bologna. Surrounded by medieval walls, it has for centuries been famed for its art pottery called "faience" (q.v.). On the principal square are the cathedral (1474), the former palace of the Manfredi, now the city hall, and the church of S. Michele. There is an arcaded market-place, and the municipal art gallery has frescoes, sculptures, and fine specimens of local majolica. Silk spinning, weaving, and sulphur refining are carried on. Founded by the Romans, Faventia was the scene in A.D. 542 of the defeat of the Byzantines by Totila, and was prominent in the medieval wars of the Guelphs and the Ghibellines. Captured in 1240 by Frederick II, Faenza fell successively to the Manfredi, the Borgias, Venetians, and the popes. Used as a German military base late in 1944, Faenza was captured by New Zealand troops of the 8th army on Dec. 16. Several palaces and museums were damaged in the battle, the Germans bitterly resisting the Allied forces. Pop. (1951) 48,211.

Faerie Queene, THE. Poem by Edmund Spenser, published in 1590-96. The published poem consists of six books, divided into 12

cantos, between 50 and 60 stanzas in each canto, and is written in nine-line stanzas, each ending with a twelve-syllable line. The poem blends the Arthurian legend of knights errant with classical lore, Christian teaching, and allegory, both general (concerning the virtues and vices) and particular (concerning people of the poet's time). Devised as an allegory on a grand scale, and only half completed, it remains a wonderful medley of poetic romance, shot through with threads of allegory, full of descriptive beauty and rich verbal music.

Faeringehavn. Harbour on the S.W. coast of Greenland, opened in Dec., 1937. The harbour is free of pack-ice for the greater part of the year. Enlarged and provided with modern loading equipment, it became an important base during the U.S. occupation of Greenland in the Second Great War.

Fafnir. The treasure-guarding worm or dragon of Scandinavian and Teutonic mythology. In both a smith's brother is supposed to have been transformed into this form. In the Scandinavian *Volsung Saga*, Sigurd slays Fafnir, guardian of Ardvora's hoard, and is thereafter known as Sigurd Fafnirsbane; while in the *Nibelungen Lied* Siegfried kills Fafnir, who guards the Nibelung hoard.

Fagaceae. Family of trees. The fruit is enclosed in a cup. The family includes sweet chestnut (*Castanea*), oak (*Quercus*), beech (*Fagus*).

Fagan, JAMES BERNARD (1873-1933). British dramatist. He was born May 18, 1873, and educated at Clongowes Wood College and Trinity College, Oxford. He was trained as an actor under Benson and Tree, and his first play, *The Rebel*, was performed in 1899. It was followed by *The Prayer of the Sword*, 1904; *Under Which King*, 1905; *The Earth*, 1909; *A Merry Devil*, 1909; *And So to Bed*, 1926; *The Greater Love*, 1927; *The Improper Duchess*, 1932. Fagan returned to acting in 1913, and was long associated with the Playhouse, Oxford. He died in Hollywood, U.S.A., Feb. 17, 1933.

Fagging. Old-established system at English public schools under which the older boys are empowered by the school authorities to exact certain duties from the younger boys. The duties, formerly heavy, now consist of running errands, tidying studies, etc., and games fagging. The system, sometimes elaborately organized, varies at different schools. All boys are liable to fagging until they reach a certain form or have been

at the school a certain length of time. As a rule the prefects alone are entitled to fags, but some schools extend the privilege to the sixth form and also to the cricket eleven and football team.

Faggot OR FAGOT. Term used in iron making. In one method of making wrought iron, a rough box of scrap or muck bars is filled with a mixture of iron and steel scrap. This faggot is then reheated and rerolled to expel more slag. The same term is used in the manufacture of shear steel; blister bars are hammered down at red heat to plated bars, which are then piled in groups of six, forming a faggot.

Faggot Voter. Name given to a class of voters, now non-existent, at elections in England. The main qualification for a vote in the counties was the ownership of land worth 40s. a year. When the system was instituted in the 15th century this meant a considerable estate, but in the 18th century it meant little. Landowners therefore gave patches of ground to their servants on the implied condition that they voted as their masters wished, a practice not destroyed till the Reform Act of 1884.

Fagin. Character in Dickens's novel *Oliver Twist* (*q.v.*). A disreputable old Jew, he is a prominent member of the criminal gang to which Bill Sikes belongs, his special province being the training of young boys to be pickpockets.

Faguet, ÉMILE (1847-1916). French critic and literary historian. Born at La-Roche-sur-Yon, Dec. 17, 1847, he became professor of poetry at the university of Paris, 1897, and a member of the Academy, 1900. His writings, which are characterised by a catholicity of taste and a flexibility of judgement reminiscent of Sainte-Beuve, include *La Tragédie au XVIe Siècle*; a series of studies of great French authors of the 16th, 17th, 18th, and 19th centuries; *Politiques et Moralistes du XIXe Siècle*; and monographs on Voltaire, Flaubert, and Zola. He died June 6, 1916. Consult *Émile Faguet*, A. Seché, 1904.

Fa-Hien OR FA-HSIEN (*fl.* A.D. 400). Chinese traveller and antiquary. A Buddhist monk, he set out in 399 from the ancient capital Hsian-fu, Shensi, for a prolonged pilgrimage in the Buddha's cradle-land. Traversing the Gobi desert, mostly afoot, to Khotan, he crossed the Hindu Kush into the Afghan valleys, and remained ten years, visiting Peshawar and the Ganges cities. He proceeded by sea in 412 to Ceylon, whence he

returned home in 414, with numerous pictures, images, and books. The account of his pilgrimage was translated into English by H. A. Giles, 1923.

Fahlun OR FALUN. Town of Sweden, capital of the govt. of Kopparberg. It stands near Lake Runn, 57 m. by rly. W. of Gävle. The town was burnt down in 1761. Its only notable feature is the 14th century church, which escaped the fire. Minor buildings include the town hall, a mineralogical museum, and technical schools. Its copper mines, once the richest in Europe, now nearly exhausted, have been worked for six centuries, and the company owning them has existed since about 1345. Iron pyrites, gold, silver, and sulphur are still produced. Fahlun has railway wagon works, wood pulp factories, and textile industries. Pop. 15,327.

Fahrenheit, GABRIEL DANIEL (1686-1736). A German physicist. Born at Danzig, May 14, 1686, he spent his life chiefly in England and Holland, where he studied physics and constructed meteorological instruments. His name is commemorated by a thermometric scale. He died in Holland, Sept. 16, 1736.

Fahrenheit Thermometer. A scale for measuring heat invented by G. D. Fahrenheit. He obtained temperatures 32° below the freezing point of water, and fixed that degree of cold as the zero of his scale. The freezing point of water thus became 32° F. The difference in temperature between this and the boiling point of water Fahrenheit divided into 180 degrees, so that the latter is 212° F.

The Centigrade scale of temperature has the melting point of ice for its zero, and the boiling point of water is fixed at 100 degrees. Réaumur's scale (used in Germany) divides the difference between the freezing and boiling points of water into 80 degrees. To convert these scales:

$$F = \frac{9}{5} C + 32 = \frac{9}{5} R + 32$$

$$C = \frac{5(F - 32)}{9} \quad R = \frac{4(F - 32)}{9}$$

See Centigrade; Thermometer.

Faidherbe, LOUIS LÉON CÉSAR (1818-89). French soldier. Born at Lille, June 3, 1818, he entered the engineers in 1840. Almost at once he saw service in Algiers, and in 1854 he was appointed governor of Senegal. France was entering upon her policy of acquiring colonies in Africa, and of this Faidherbe was a pioneer. Made general in 1863, he returned to France in 1870 to lead the armies of the north after the

disasters at Sedan and Metz. He showed great ability when fighting a number of battles against heavy odds, but at last he was beaten at St. Quentin, Jan. 19, 1871. For a short time he sat in the national assembly, and in 1879 he was elected to the senate. Faidherbe was also an Egyptologist. He died in Paris, Sept. 28, 1889.

Faidit, GAUCELM (c. 1159-1216). A French troubadour. Born at Uzerche in Limousin, the son of an artisan, he attracted by his singing the patronage of Richard Coeur de Lion. About 70 of his poems have been preserved, including a beautiful *planh*, or song of sorrow, in memory of Richard.

Faïence. Term loosely used to designate every description of glazed pottery and earthenware painted with decorative designs. The name comes from the Italian city of Faenza, which has made a speciality of this kind of ware from the close of the 13th century. It had a soft paste and thin transparent glaze, which heightened the colours. The very rare French Oiron ware is called Henry II faïence. Some varieties from Josiah Wedgwood's work are styled English faïence. See Pottery.

Failsworth. Urban dist. of Lancashire, England. It is 4 m. N.E. of Manchester, with a rly. station. In the Manchester area, although just outside the city boundary, its main industries are connected with the manufacture of cotton. Water is supplied from Oldham. Pop. (1951) 18,033.

Fainting OR SYNCOPE. Temporary unconsciousness due to insufficient supply of blood to the brain. Among causes leading to the condition are defective action of the heart, sudden violent emotion, over-exertion, loss of blood, blows on the head or abdomen. A person about to faint feels giddy, and everything around him seems to be becoming dark. He turns pale, the pupils dilate, the skin becomes cold, and if standing he falls heavily. The pulse is weak and hurried.

Recovery is usually rapid. So long as he is unconscious, the person should be allowed to lie quietly on his back with his head as low as possible, and the clothing about the neck and chest should be loosened. If a person faints in a room the window should be opened, and if outside, onlookers should be sent away. Smellingsalts may be held beneath the nose, but until consciousness returns nothing should be given by the mouth. When swallowing is possible, a little brandy or sal volatile in water

may be given. When feelings of faintness first come on, complete loss of consciousness can often be prevented by the person bending forwards and placing his head between his knees at as low a level as possible.

Fair (Lat. *feria*, holiday). Periodical assembly of traders at a place and time fixed by charter, statute, or immemorial custom. In early times certain localities came to be used for the periodical exchange of commodities, either by reason of their situation or because they were resorted to at stated times for religious or other purposes. In Greece the Olympic games and such religious festivals as those of Delos and Delphi provided occasions for trading. Among the Incas of Peru fairs were held thrice a month in the most populous places and were visited by the outlying agricultural populations. In ancient Mexico, fairs took place every fifth day in the chief cities.

The earliest royal charter for a fair was granted in 642 by the Frank king Dagobert to the monks of S. Denis, Paris. The concourse of worshippers at a famous shrine afforded great opportunities for trade, and nearly all medieval fair charters were granted to ecclesiastics. The fairs were usually held on a saint's day and on its vigil and morrow, and often, until prohibited by statute, in the churchyard. The religious associations of medieval fairs are indicated by the German word for "fair," *Messe* (mass), and in the term *kermesse* or *kirmess* (church mass) used for the quasi-religious carnivals of Brittany and the Low Countries. In every fair there was a court specially appointed for settling disputes, called in England *pie-powder courts* (*q.v.*).

Fairs and Trade

To promote trade, fairs were encouraged by the sovereigns of Europe. During fair time in the 10th century Otto the Great pronounced the ban on breakers of the peace and suspended the right of private feud. In the 14th century the emperor Charles IV's charter for the great fair of Frankfort-on-Main declared fair-goers free from arrest and imperial taxes during the fair as well as for 18 days before and after.

Though fairs were invaluable for international trading, local traders were usually compelled to close their shops in fair time. During the Westminster fair the city tradesmen were commanded to shut their shops, and during the fair on St. Giles's Hill, near Winchester, which lasted 16 days, the Winchester and the Southampton shopkeepers were only allowed to

trade in the fair. The bishop of Winchester was the lord of the fair, and while it lasted the powers of the regular city officers were in abeyance. On the Eve of S. Giles the keys of the city gates were handed over to the bishop, who appointed a mayor, bailiff, and coroner of his own for the duration of the fair.

The influence of country fairs was far-reaching. In 1338 the statutes of St. Mary Ottery's College in Devonshire ordained that 200 lb. of wax for the choir should be bought annually at Winchester fair. In the 15th century the monks of Maxstoke and Bicester laid in their yearly stores at Stourbridge fair, and in the 16th century it was still customary for stewards of country houses to purchase their year's supply of household stores at remote fairs. With the improvement in communications the importance of fairs diminished, and by 1855 all those in London were abolished.

"Fun of the Fair"

Amusements formed an important feature of fairs, many of which became mere disorderly revels and were suppressed as nuisances. This was the fate of Donnybrook fair in Dublin, of Charlton or Horn fair, of Greenwich fair, and of all the London fairs. The "fun of the fair" included jugglers, mountebanks, rope-dancers, acrobats, wrestling and other sports, wild beasts, learned animals, freaks and monstrosities, puppet-shows, miracle plays, mysteries, moralities, and stage plays of every description; ballad-singing, grinning through horse-collars, swings, roundabouts, and, in modern times, steam music. Ballad-singers were very popular at fairs; Outroaring Dick and Wat Wimbers, two Elizabethan trebles, were paid as much as 20 shillings a day at Braintree fair. Of fairings, or gifts bought at fairs, the most familiar are the little gingerbread figures, usually gilt, possibly a survival of images of saints.

The most celebrated London fair was Bartholomew fair (*q.v.*), and among existing English livestock fairs may be mentioned those for horses at Horncastle (described in George Borrow's *Romany Rye*), Barnet, and Woodbridge; Weyhill, for sheep, and Ipswich, for lambs; Exeter, for cattle and horses; and Carlisle and Ormskirk, for cattle. Nottingham has a goose fair; Falkirk, a fair, or *tryst*, for cattle, sheep, and horses; and Ballinasloe, co. Galway, one for cattle. Gloucester cheese fair is well known. In parts of England and Wales, and in Scotland, servants were engaged at the hiring, or statute fairs.

On the continent of Europe, the Lyons fair is supposed to have been founded by the Romans and long enjoyed a great reputation; bills of exchange from all parts of Europe were often made payable at Lyons fair. The fairs of Champagne and Brie were world renowned, and are referred to as early as the 5th century. Those of Frankfort-on-Main and Frankfort-on-Oder and those of Leipzig, especially the great Easter book-fair, were the best known German fairs. The most important Russian fair was the Makaryevskaya fair at Nijni-Novgorod (Gorki), July 29–Sept. 10. Held from remote times at various points on the Volga, it was settled at Nijni in 1817, taking its name from a monastery near Makaryev, where it was formerly held. The fair once comprised over 8,000 shops as well as circuses, theatres, banks. Trade was carried on in cotton, woollens, silk and linen goods, furs, iron, corn, salt, etc.

In the Nile delta Tanta is famous for its fairs, held thrice yearly at the tomb of Said el Bedawi, a 13th century saint. One of the largest fairs in Asia is that at Hardwar, or Hurdwar, in Upper India. The Meccan fairs existed long before the time of Mahomet. In the U.S.A. the term denotes an industrial exhibition. *See* Exhibition.

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Fairbairn, ANDREW MARTIN (1838–1912). British theologian. Born near Edinburgh, Nov. 4,



Andrew M. Fairbairn,
British theologian
Elliott & Fry

1838, and educated at the university there and at Berlin, for some years he was a Congregational minister at Bathgate and Aberdeen. He became principal of the Aire-dale Congregational College, Bradford, in 1877, and in 1889–1909 was principal of Mansfield College, Oxford. He was Muir Lecturer at Edinburgh, Gifford Lecturer at Aberdeen, and Lyman Beecher Lecturer at Yale. He published numerous books chiefly on the philosophy of religion, among them *The Place of Christ in Modern Theology*, 1893, and *Philosophy of the Christian Religion*, 1902. He died Feb. 9, 1912.

Fairbairn, SIR WILLIAM (1789–1874). British engineer. Born at Kelso, Roxburghshire, Feb. 19,



Sir W. Fairbairn,
British engineer

1789, the son of a farmer, in 1804 he was apprenticed to a millwright in Newcastle, and educated himself in his spare time. Coming to London in 1811, in 1817 he started in partnership with James Lillie an engineering business which proved successful. In 1830 he turned his attention to iron boat construction, and in 1835 opened shipbuilding works at Millwall. Moving thence to Manchester he invented a riveting machine, and superintended the construction of the Menai Bridge, 1848. He was made a baronet in 1869, and died Aug. 18, 1874.

Fairbanks. Town of Alaska. Situated on the river Tanana, it is the centre of government activities in the interior of Alaska, and is connected by the Alaska rly. with Seward (*q.v.*), 467 m. S. It is the N. terminus of the Alaska Highway (*q.v.*). Fairbanks became a U.S. air and army base during the Second Great War, and an experimental flying station was built on the outskirts. Pop. (1950) 27,553.

Fairbanks, DOUGLAS (1883–1939). American film actor. By name Douglas Ullman, he was born at Denver, May 23, 1883. Making his first appearance on the New York stage in 1901, he adopted the screen as his profession in 1914 and formed his own company in 1917. Athlete as much as actor, he endeared himself to audiences by the dash, verve, and charm with which he portrayed romantic historical and legendary heroes. His silent films included *The Three Musketeers*, *Robin Hood*, *The Thief of Bagdad*, *The Gaucho*, *The Iron Mask*; among his talking films were *The Taming of the Shrew*, *Around the World in 80 Minutes*, *The Private Life of Don Juan*. From 1920 to 1935 he was married to Mary Pickford (*q.v.*), and in 1936 to Lady Ashley. He died Dec. 12, 1939.

Douglas Fairbanks, junior (b. 1907), son of the above and his first wife, Beth Sully, was born Dec. 9, 1907, educated at Pasadena polytechnic school and Harvard military academy, and became a film actor. He first appeared in 1923, and in 1935 started his own company. The Amateur

Gentleman, *The Dawn Patrol*, *Catherine the Great*, *The Prisoner of Zenda*, *The Young in Heart*, were among his successes. Chairman of C.A.R.E., 1948, he was made an honorary K.B.E., 1949.

Fairbridge, KINGSLEY OGILVIE (1885–1924). South African founder of the movement for settling children from Great Britain on farm schools in the countries of the Commonwealth. Born at Grahams-town, Cape Province, May 2, 1885, he was a Rhodes scholar at Exeter College, Oxford, and in 1909, with 49 fellow undergraduates, formed the Child Emigration Society (later renamed the Fairbridge society, with h.q. at 38, Holland Villas, London, W.14). Fairbridge sailed for Western Australia in 1912, and started with his wife the first Fairbridge farm school at Pinjarra with 35 boys. By 1934 the prince of Wales was appealing for £100,000 for more schools on the same model; the result was the founding of the Prince of Wales Fairbridge farm school on Vancouver Island, near Duncan; a fruit farm at Fintry, B.C.; another school at Molong, N.S.W. There is also a memorial college near Bulawayo. Fairbridge died July 19, 1924, at Perth, W. Australia.

Fairey, SIR (CHARLES) RICHARD (1887–1956). British aeronautical engineer. He was born May 5, 1887, and educated at Merchant Taylors' and Finsbury technical college. He was manager of the Blair Atholl Aeroplane Syndicate, 1911–13, and in 1915 founded the Fairey Aviation Co., Ltd., which produced in the Second Great War the *Swordfish*, the *Barracuda*, the *Firefly* and other war aircraft. His company was the first to produce an aircraft that officially exceeded a speed of 1,000 m.p.h.—the *Fairey Delta II* which reached 1,132 m.p.h. in 1956. Fairey was president of the Royal Aeronautical Society, 1930–31 and 1932–33. Knighted 1942, during 1942–45 he was director-general of the British air commission at Washington. He died in London, Sept. 30, 1956.

Fairfax, FERDINANDO FAIRFAX, 2ND BARON (1584–1648). English soldier. The son of a Yorkshire landowner, he was born March 29, 1584, and when young served against Spain in the Netherlands. In 1640 he succeeded his father as Baron Fairfax of Cameron, a Scottish title dating from 1627, but this did not prevent him from becoming a member of the Long Parliament. Therein, taking the

side of the parliament, he was chosen to command its forces in Yorkshire when war began in 1642. He served for about two years, but met with only one or two minor successes; he was routed at Adwalton Moor, and driven from the field at Marston Moor. He died March 14, 1648.

Fairfax, THOMAS FAIRFAX, 3RD BARON (1612–71). English soldier. The son of the 2nd baron (*v.s.*), he was born at Denton, Yorks, Jan. 17, 1612. He went to S. John's College, Cambridge, after which he saw military service in the Netherlands. In 1640 he fought against the Scots, but when the civil war began in 1642 he and his father were prominent among the king's opponents. Thomas was present at Marston Moor in 1644. On the passing of the self-denying ordinance, he was made commander-in-chief of the parliamentary armies, and as such gained the victory at Naseby. At the end of the first period of the war he was something of a national hero.

He had little sympathy with the policy of the more violent of the army leaders. He helped to put down the royalist rising in 1648, and was one of the judges appointed to try Charles I; but when the trial began he refused to sit, and in 1650 he refused to march against the Scots and resigned his position as head of the army, receiving a pension of £5,000 a year. In 1659–60 he helped Monk to place Charles II on the throne, going as head of the deputation to The Hague. He was elected as M.P. for Yorkshire to the new parliament, and that was the end of his public career, although he lived until Nov. 12, 1671. Fairfax was a man of culture who wrote two accounts of his campaigns, verses, and made translations. His correspondence was published in four volumes, 1848–49. The *Great Lord Fairfax*, by Sir C. R. Markham, appeared in 1870.

Thomas Fairfax, who became the 6th baron, sold Denton Hall, the Yorkshire seat of the family, and settled in Virginia, where he lived in princely splendour. His brother, the 7th baron, died without sons, and the title passed to



From an engraving

a distant relative. For a time, the heirs being American citizens, it was not claimed, but in 1912 Albert Kirhy Fairfax (1870-1939) was permitted by the house of lords to call himself 12th baron. Dying Oct. 4, 1939, he was succeeded by his son Thomas (b. 1923).

Fairfax, SIR JAMES READING (1834-1919). An Australian newspaper proprietor. Born at Leamington, England, Oct. 17, 1834, he joined the staff of his father's paper, the Sydney Morning Herald, in 1851. Five years later he became a partner, and during the remainder of his life was actively engaged in the management of the Sydney Mail, which he founded. Knighted in 1898, he was president of the national art gallery of N.S.W. He died March 28, 1919.

Fairfield. Mountain in Westmorland, England. Its peak reaching 2,863 ft., it lies S. of Helvellyn and can be ascended from Grasmere. Fairfield is also the name of suburbs of Liverpool, Manchester, and Buxton.

Fairford. Parish and village of Gloucestershire, England. It stands on the Coln, 25 m. W. of Oxford, with a station on a branch rly. Its 15th century church, dedicated to S. Mary, and built by John Tame, a London merchant, contains some of the most wonderful stained glass in the country. The 28 windows figure the whole story of the Creation and of the work of Jesus Christ. The village, formerly a centre of cloth manufacture, is visited for trout fishing. It was the birthplace of John Kehle. In the neighbourhood are Hatherop Castle and Fairford Park. Pop. (1951) parish, 2,439.

Fair Head or BENMORE. Headland on the N. coast of Antrim, N. Ireland. It is 4½ m. N.E. of Ballycastle, is 636 ft. high, and being a sheer precipice from a height of 320 ft. presents a superb basaltic columnar formation.

Fairing. A cover or casing placed over certain parts of an aeroplane, motor vehicle, or railway train so that the aircraft or vehicle offers the minimum resistance to the air when travelling at speed. Fairing is a fundamental part of streamlining; in streamlined motor vehicles such protuberances as door handles, headlamps, etc., are faired into the body and wings. On streamlined trains the smoke-stack is faired into the boiler covering and the coachwork of the carriages is cleanswept from the roof to within a few inches of the rails. On air-

craft protuberances are reduced to a minimum by fairing them into the fuselage and wings.

Fair Isle or SHEEP ISLE. One of the Shetland Is., about equidistant from Mainland in that group



Fair Isle, Shetland Islands, from the east, with the lighthouse on the southern extremity
Valentine

and the Orkney Is. It is 3 m. long and 2 m. broad, and rises to 480 ft. in Sheep Craig on the E. coast. Fishing and sheep-rearing are engaged in, and the island gives its name to a characteristic style of knitting popular for pullovers and jumpers. This may have been learnt from Spaniards of the Armada who were wrecked here. The island has two lighthouses, and is in telegraphic communication with the mainland. Long a bird sanctuary, Fair Isle in 1948 became the property of an Edinburgh ornithologist who in 1954 transferred it to the National Trust for Scotland. Pop. (1956) 45.

Fairlie. Village of Ayrshire, Scotland, on the Firth of Clyde, 2 m. S. of Largs. It has a yacht-building yard, and castle ruins.

Fair Maid of Perth, THE, OR ST. VALENTINE'S DAY. Romance of Scotland in the last years of the 14th century. Published in May, 1828, it forms the second series of Scott's Chronicles of the Canonicate. The titular heroine is Catharine, the beautiful and devout daughter of Simon Glover, Burgess of Perth. In addition to the unique study of the Highland lad Conachar (Eòghin Mac-Ian), nominally Simon's apprentice, who is destined to be the last chief of the Clan Quhele, and whose inherent cowardice offers a striking contrast to the dauntless courage of Henry Smith (Hal of the Wynd), the armourer who is also Catharine's suitor, the story contains a vivid description of the Palm Sunday battle on the North Inch between the champions of the rival clans Chattan and Quhele.

Fair Oaks, BATTLE OF. Federal victory in the American Civil War, May 31-June 1, 1862, also known

as the battle of Seven Pines. In command of the Federals, McClellan was forcing Johnston back upon Richmond when the Southern general made a stand as the Federals were crossing the Chick-

ahominy river. Two of McClellan's corps were already to the S. of the river when they were attacked by Longstreet. Reinforcements were hurried up, and stubborn fighting took place, during which Johnston was severely wounded, being succeeded by G. W. Smith. The next day, June 1, Long-

street's attack was repulsed, and Lee arrived in time only to withdraw the Confederate army to Richmond. About 42,000 men were engaged on either side. The Federal losses were 5,000, the Confederates losing more than 6,000.

Fair Trade. Term much used in the United Kingdom during the latter part of the 19th century for what was later called tariff reform. It was used by the opponents of free trade, who demanded that the United Kingdom should admit the goods of other nations only on the same terms as British goods were admitted by them. After languishing for a time the cause revived early in the 20th century in the shape of Tariff Reform. See Free Trade; Tariff Reform.

Fair Wages Clause. Clause which, in accordance with a resolution of the British parliament, must be included in all government contracts and which requires contractors to pay wages and observe hours and conditions of labour not less favourable than those established in the district by negotiation or arbitration between employers' organizations and trade unions. Workers must be free to join a trade union. The contractor must see that his subcontractors observe the clause. It is included in contracts made by local authorities, in other contracts involving expenditure of public money, and in industries regulated by Act of parliament, such as the sugar and film industries, road and air traffic, navigation.

The first resolution requiring a fair wages clause was introduced in the house of commons by Sidney Buxton in 1891. The form was amended in 1909 and 1946. The clause was necessary because some

employers in their anxiety to obtain government contracts put in very low tenders which could be made profitable only if they cut their rates of wages. Without it public contracts would tend to go to the worst employers.

Fairway. Navigable part of a river or other channel. It is continually under supervision to keep it free from obstructions. The term is used in golf for the direct path of short grass between tee and green.

Fair Wear and Tear. Term used in contracts. It is frequently provided in tenancy agreements or in agreements for the hire of chattels that the tenant or hirer shall be bound to keep the house or chattel in good repair, "fair wear and tear excepted." The phrase has been used in legal documents for centuries. Its effect is to negative any liability for (1) damage due to the normal or ordinary operation of natural causes such as wind and weather as distinct from damage due to abnormal natural events such as lightning, hurricane, flood, or earthquake; (2) damage caused by the tenant either unintentionally or as a normal incident of a tenant's occupation or use.

Fairweather. A mountain of Alaska, U.S.A. It is a volcano in the St. Elias Range, alt. 15,300 ft.

Fairy. Legendary or mythical being common to the folklore of most peoples. Fairies are manifested in varied forms, from tiny creatures in human shape which haunt the flowers, to the ordinary size of human beings. They are, however, generally regarded as relatively small, whence it has been surmised that the origin of the fairy myth is to be found in a dim antiquity when surviving races were in conflict with smaller races that have become extinct. The discovery of the African pygmies has lent colour to this; Sir Harry Johnston pointing out that the actions of those dwarf people again and again suggested the traits attributed to the brownies and goblins of fairy lore. Fairies in their many manifestations are sometimes friendly and beneficent, sometimes mischievous and malevolent.

The term is occasionally employed as covering the whole field of terrestrial supernatural beings; hence Fairyland is a sort of fourth dimensional world that coexists with that in which we live, and the term fairy stories is applied to all tales introducing earthly beings of an extra-natural character. In poetry and modern fairy stories the fairy is generally represented

as a tiny dainty creature. Since fairy originally meant enchantment, and then fairy people collectively, a single fairy is better called fay, Fr. *fée*, Ital. *fata*, from late Lat. *fata*, a fate or fay, the neut. pl. of *fatum* being used as a singular. See Brownie; Change-ling; Elf; Folklore; Gnome; Goblin; Puck; Sylph.

Bibliography. Teutonic Mythology, Jakob Grimm, 1835 (Eng. trans. J. S. Stallybrass, 1880-88); Fairy Mythology, T. Keightley, 1847; Science of Fairy Tales, E. S. Hartland, 1889; British Fairy Origins, L. Spence, 1946.

Fairy Ring. Ring of a more vivid green than the surrounding grass of fields, fancifully ascribed to fairies dancing in a circle at night. It is actually caused by the growth of certain species of fungi—notably the fairy-ring champignon (*Marasmius oreades*)—which, starting from the centre, extend their underground threads (*mycelium*) in all directions, forming a circle increasing every year.

Fairy Shrimp (*Chirocephalus diaphenus*). Species of fresh water crustacean belonging to the sub-class Entomostraca. Within this sub-class is the primitive order Branchiopoda, containing two sub-orders Cladocera and Phyllopoda. The fairy shrimp is a phyllopod; a beautiful creature, semi-transparent, it is not widely found but is reasonably plentiful in certain parts of England.

Faisans, ÎLE DES (Fr., Pheasants' Isle). Island in the river Bidassoa, lying between France and Spain, about 15 m. S.E. of San Sebastian. Its position between two frontiers made it on two notable occasions the meeting-place of French and Spanish negotiators. Louis XI and Henry IV of Castile met here in 1463, and Mazarin and Don Luis de Haro here concluded the treaty of the Pyrenees in Nov., 1659, by which Spain ceded Artois and other northern possessions, and gave up her claims to Alsace and Lorraine, while France gave up territory taken in Italy and N.E. Spain.

Faith (Lat. *fides*). In ordinary speech a term used to denote the leap of the mind from the known to the unknown. In the sphere of nature it signifies the acceptance of fundamental assumptions which in themselves are incapable of logical demonstration. The law of the Uniformity of Nature, for instance, is an act of scientific faith enunciating a universal principle on the basis of certain established data. The fact that the sun has invariably risen at daybreak does

not in itself afford a demonstrative proof that it will always rise, but justifies our faith that it will. In the sphere of human relations the term is also employed to denote the confidence which we feel in other men whose character and integrity are known to us.

From ordinary usage the term naturally passed into the religious sphere—to which it pre-eminently belongs—and is commonly used to describe the faculty or organ of the soul by which a man grasps the realities of the unseen and divine universe. What the eye is to the body, faith is to the soul. It is the medium or instrument by means of which the soul enters into communion with God.

Philosophers and theologians have made many attempts at a psychological analysis of the faculty of faith. Some have held that it is a divine endowment—a special religious sense, created in the soul for the purpose of the exercise of spiritual functions. Others have regarded it as an aspect of the emotions analogous to the aesthetic sense. A third school has made it a department of the intellectual side of human nature; while a fourth has located it in the activity of the will. All these theories are inadequate, for intellect, feeling, and will are all involved in the act of faith, which has been defined as "a resolution to stand or fall by the noblest hypothesis."

Corresponding to these different views as to the character of the organ of faith, there are similar divergences of opinion as to the scope of its activity. Even in the N.T. the term is used in three different senses. In the Epistle of James it is employed to signify the intellectual assent of the mind to the primary Christian beliefs, and from this use of the word has grown up the conception which identifies faith with the acceptance of a creed. In the Epistle to the Hebrews, on the other hand, faith is defined as "the assurance of things hoped for, the proving of things not seen," words which Dr. Moffatt has paraphrased, "Faith means we are confident of what we hope for, convinced of what we do not see." It is out of this interpretation of faith that Christian mysticism developed. To the Apostle Paul faith has still a deeper significance. It implies nothing less than the complete surrender of the soul to Christ as its Redeemer and its Lord. And it is to this great idea of faith that the Evangelical interpretation of Christianity owes its genesis and inspiration.

Faithful. Character in Bunyan's Pilgrim's Progress. He meets Christian during his journey to the Celestial City and the two travel together to Vanity Fair, where Faithful is put on trial, condemned to death, and burnt, but is taken up to the City in a chariot.

Faithfull, EMILY (1835-95). A British publicist. Born at Headley rectory, Surrey, and educated at



Emily Faithfull,
British publicist
Downey

Kensington, she devoted the greater part of her life to advocating the claims of women to remunerative employment. In 1860, in Great Coram Street, London, she founded a printing office in which women were employed as compositors, and for which she secured the approval of Queen Victoria. Later, in Farringdon Street, she formed the Victoria Press, and was appointed printer and publisher in ordinary to the queen. In 1863 she started a monthly entitled The Victoria Magazine. In 1868 she issued a novel, Change upon Change. Her lectures in the U.S.A., 1872-73, were described in her Three Visits to America, 1884. She received a civil list pension of £50 in 1889 and died May 31, 1895.

Faith Healing. Cure of disease by faith in the healing power of God. In the early Church the practice of anointing the sick for the purpose of curing them was a normal function of the clergy, and still survives in an altered form and with different intention in Extreme Unction. In medieval days the touch of a saint or of his relics was resorted to for healing; and down to the time of Queen Anne the British sovereign used to touch persons to cure them of scrofula.

The practice of faith healing is common among certain Protestant bodies, such as the Peculiar People and Four-square Gospellers. Most of the miracles at Lourdes and elsewhere are probably examples of faith healing. Such cures are usually effected in functional and nervous complaints, not in cases of organic lesion; and medical science attributes them to the power of suggestion upon the minds of persons who are at the time in a state of strong religious emotion. See Christian Science.

Faithorne, WILLIAM (1616-91). English engraver. Born in London, he studied painting and draw-

ing under Robert Peake, and engraving with John Payne. Made prisoner by the Roundheads in the Civil War, he pursued his art in Aldersgate prison, and on his liberation proceeded to Paris, becoming a pupil of Robert Nanteuil. Returning to London in 1650, he set up as a print-seller near Temple Bar, retiring 1680. He was buried at Blackfriars, London, May 13, 1691. Faithorne engraved portraits of most of the conspicuous figures of the Commonwealth and Restoration after Van Dyck, Lely, Dobson, and others, among them the notorious Lady Castlemaine. His portraits of Charles I, Charles II, James II, the duke of Monmouth, Milton, Killigrew, and Hobbes may be mentioned.

Faiyum. Another spelling of the name of the province in Upper Egypt described as Fayum.

Faizabad OR FYZABAD. Division, district, and town of the Uttar Union, India. Faizabad city, the administrative headquarters (formerly with cantonment) of the district, is situated at the junction of three branches of the Northern railway, and forms with Ajodhya a single municipality. Its chief industry is sugar refining, and it has a large agricultural trade. It is the terminus of the river steamers on the Gogra, and has a college affiliated to Agra University. The main crops of the district are rice, gram, wheat, lentils, peas, barley, and sugar-cane. Pop. (1951) div., 8,362,712; dist., 1,481,796; town, 76,582.

Fakenham. Parish and market town of Norfolk, England. It stands on the Wensum, 24 m. by rly. E.N.E. of King's Lynn. It has

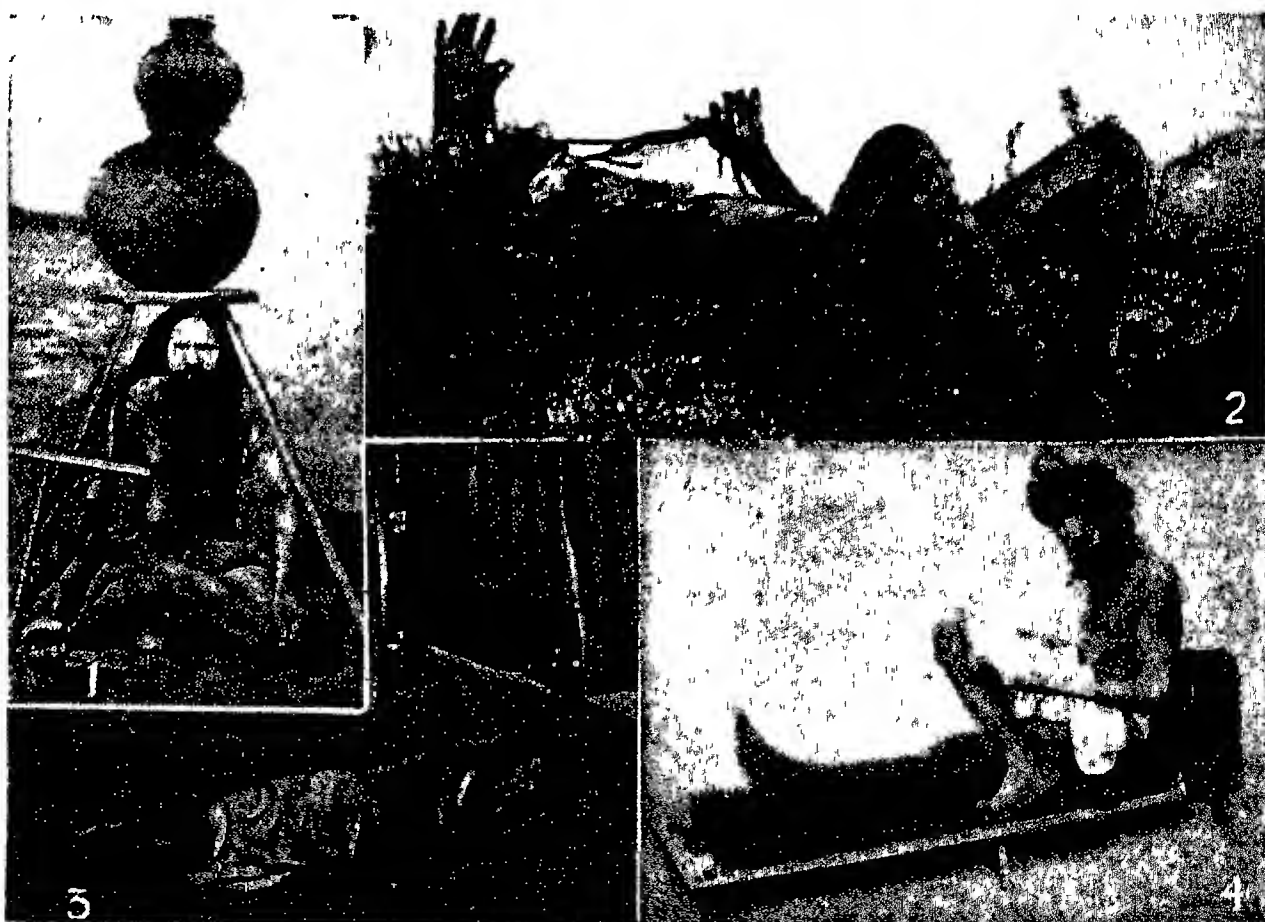
two railway stations, one mile distant from each other. The chief building is the church, with a lofty tower. Pop. (1951) 2,933.

Fakir (Arab. *fakir*, beggar). Religious devotee, especially in India. Fakirs number perhaps a million, the majority of them being Mahomedans, while others are Hindus, Sikhs, or Jains. The Mahomedans are orthodox members of the marrying dervish orders or unorthodox celibate mendicants who dispense with abstinence, fasting, and prayer. The Hindus include members of the monastic yogi orders devoted to education and poor relief, besides mendicant vagabonds who practise jugglery and resort to mutilations and austerities. See illus. below.

Fal. River of Cornwall, England. It rises near Roche, flows S. and S.W. 23 m. to the English Channel at Falmouth, and is navigable for nearly 10 m.

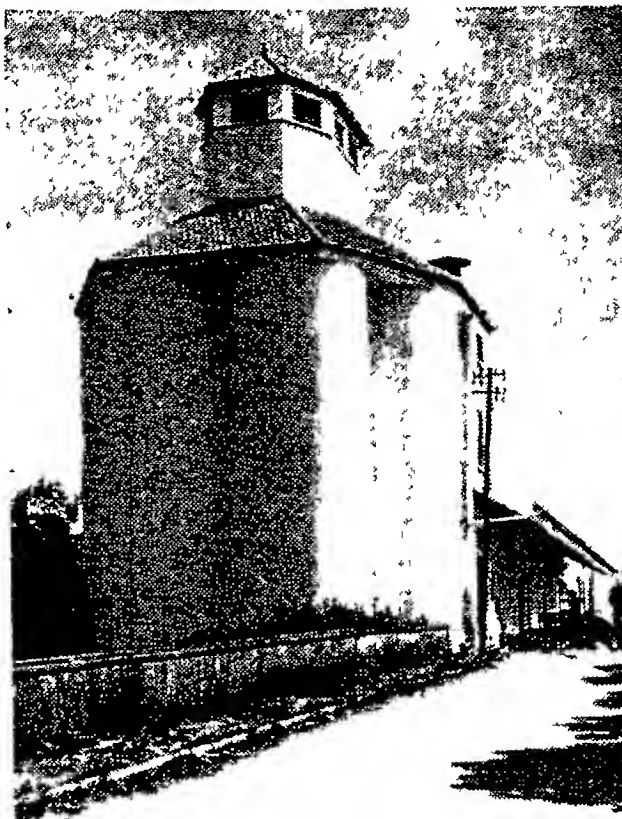
Falaba. British liner torpedoed by the German submarine U28 S. of St. George's Channel, March 28, 1915. She sank in a few minutes with the loss of 100 lives. At the inquiry it was stated that the submarine was flying British colours and its crew wore khaki. The Germans attempted to justify this attack by saying that it was a return for Great Britain's attempt to starve out Germany. The Falaba, 4,800 tons, belonged to the Elder Dempster Co.

Falaba. Town of Sierra Leone, W. Africa. It is fortified, and lies near the frontier of French Guinea, 170 m. N.E. of Freetown, at the junction of many trade routes. There is trade in palm kernels and kola nuts.



Fakir. 1. Undergoing thirst ordeal: with the river by his side and jars of water overhead, he abstains from drinking. 2. Lying on a bed of thorns. 3. Rolling his way from shrine to shrine. 4. Seated on a bed of nails

Falaise. Town of France, in the dept. of Calvados. It stands on the Ante, 20 m. S.S.E. of Caen. It is an agricultural centre, and Guibray, a suburb, is noted for its horse and cattle fairs. Other industries are tanning and the manufacture of hosiery, cottons, and dyestuffs. The chief churches were S. Gervais, with its fine Norman tower and some beautiful stonework, and the Trinity; the former was destroyed and the latter badly damaged in the Second Great War. The most interesting building is the ruined castle, famous as the birthplace of William the Conqueror and at one time the residence of the dukes of



Falaise. The castle where William the Conqueror was born. Top. Post war rebuilding in the devastated town: granary, completed 1947
Top photo, The Times

Normandy. It is on a hill above the town. Near the town hall is an equestrian statue of William the Conqueror by Louis Rochet, was erected in 1851. As part of Normandy, Falaise was long a possession of the English kings. In 1450 it was captured by the French. Pop. (1954) 5,715.

BATTLE OF THE FALAISE GAP. In mid-Aug., 1944, the Allied armies in Normandy were fighting to encircle the main body of the German 7th army by closing the Falaise-Argentan gap. British and Canadians were pressing S. towards Falaise and U.S. and French armoured units advancing N. to Argentan. By Aug. 15 the gap was only 10 m. wide and about half the German army had withdrawn. Falaise was captured by Canadians on Aug. 17, having been reduced to ruins, and U.S. troops were fighting in Argentan. Three days later the gap was closed by the Allied meeting at Chambois, and by Aug. 22 the pocket was eliminated. About 100,000 Germans were accounted for, either as casualties or as prisoners, in these operations.

during the civil war of 1936-39. At first the organization showed tendencies towards radicalism, but the Conservative military caste in the movement seized control, Franco became the head, and on April 19, 1937, the Falangists, Carlists, and other political groups in the nationalist movement were united under the title Falange Española Tradicionalista. The army was incorporated into the Falange and the influence of its national council considerably increased thereby.

As reconstituted by Franco, the Falange consisted of thirteen elements: the caudillo, or leader; the national council; the political junta; its president; the secretary general; the national delegates; the national inspectorates; the militia and syndicates; the internal services;

Falange (Sp., phalanx). Spanish fascist party formed on Oct. 29, 1933, by Primo de Rivera, eldest son of General de Rivera who was dictator of Spain under the monarchy, 1923-30. The Falangists were organized on the lines of the Italian fascist militia. They cooperated with General Franco

the regional inspectorates; the provincial groups; the local groups; and individual members. Personnel of the army, navy, and air force became individual members. The Falange was the sole political party permitted in Spain and was ruled by a national council of 100 under the presidency of Franco. In July, 1942, the Spanish cortes was re-established on Falangist lines. The Falangist militia, dissolved on Dec. 20, 1943, was incorporated into the army.

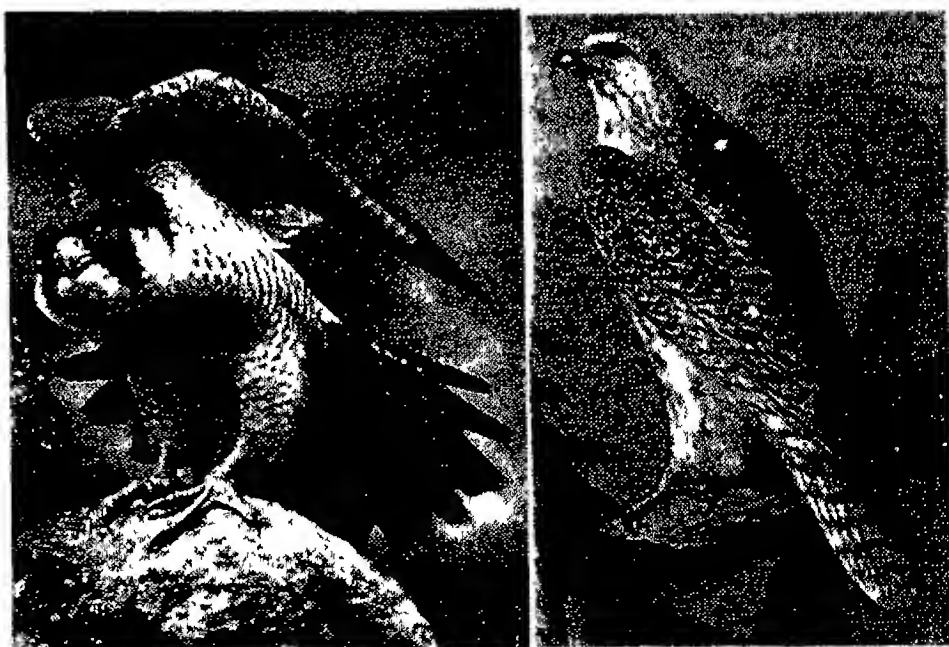
A Falangist party established in Mexico, 1937, was abolished by the government on April 5, 1939.

Falashas (Ethiop., strangers). Communities of Hamitic stock, mainly between Axum and Gondar, in Abyssinia. Although allied by blood to the Galla, and ignorant of Hebrew and the Talmuds, they profess Judaism, there being three distinct sects. They are farmers and artisans, speaking an Abyssinian (Agao) dialect, and they practise a rigid group and ritual exclusiveness with which various pagan observances are mingled.

Falces. Town of Spain, in the prov. of Navarre. It stands in a plain between the rivers Ebro and Arga, 30 m. S.W. of Pamplona. It has ruins of a Roman castle, but is chiefly known for the mineral springs in the vicinity.

Falchion. Type of sword used in medieval times. Usually slightly curved and rather heavy, the blade was broader towards the point than at the hilt. The word comes from Lat. *falx*, sickle. See Sword.

Falcon (Lat. *falco*). Name applied generally to the family of birds of prey Falconidae, which includes falcons, hawks, kites, and eagles; but more especially to the genus *Falco*, which includes the true falcons, the peregrine falcon, and the kestrels. All these have short, curved beaks with one notch in the upper mandible, round



Falcon. Two species found in the British Isles: left, the peregrine falcon; right, Scandinavian jer-falcon

nostrils, short pointed wings, and long toes.

Several species of falcon are found in Great Britain. Of these the peregrine falcon builds sparsely on cliffs in the S. of England. It preys mainly on birds, and its ravages among game are compensated by the fact that it attacks only the weaklings, and thus tends to maintain the strength of the breed. It was formerly trained to bring down birds in hawking.

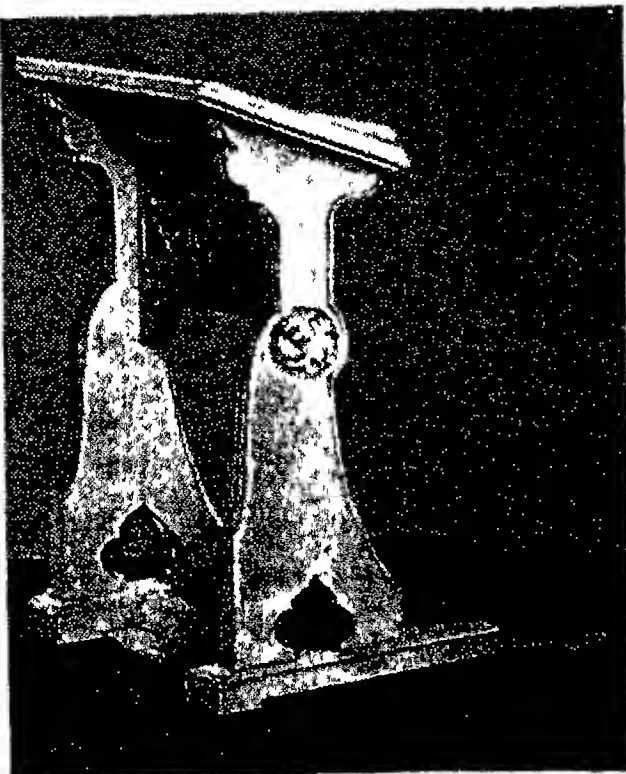
Other species which occur in the British Isles are the Greenland falcon, the Iceland jer-falcon, and the Scandinavian jer-falcon, all of which are occasional winter visitors. The birds take their name from the hook-shaped claws (Lat. *falx*, sickle). See Hawking.

Falcon. Volcanic island of the Tonga or Friendly Islands. It is in lat. 20° 20' S. and long. 175° 20' W. It made its appearance above the ocean on Oct. 14, 1885, after a volcanic eruption. It disappeared for a time, but was again uplifted.

Falcón. Maritime state of N. Venezuela, facing the Gulf of Maracaibo and Caribbean Sea and bounded S. by the state of Lara. It has been a separate state since 1904, when it was separated from Zulía. The coastal region is low-lying and sterile, but inland there are several ranges of hills with fertile valleys. Agriculture and stock-raising are the chief industries; coffee, cocoa, sugar, cotton, tobacco, and maize are produced. Coal is worked in small quantities, but the mineral resources of the state are virtually untapped. The capital is Coro. Pop. 232,644.

Falcone, ANIELLO (1600-65). Italian painter. Born in Naples, he was a pupil of Ribera, and became famous as a spirited painter of battle scenes. During the insurrection of Masaniello, 1647, Falcone gathered a band of his friends and pupils, among whom was Salvator Rosa (*q.v.*), and this "Company of Death" made many Spaniards pay with their lives for the murder of the leader's nephew and of one of his pupils. Pictures painted of these events are in the museum at Naples. Falcone worked in Paris from 1648 to 1656, when he returned to Naples, where he died. His *Fight between Turks and Cavalry* is in the Louvre.

Falconer, HUGH (1808-65). Scottish botanist. Born at Forres, Feb. 29, 1808, Falconer was educated at Aberdeen and Edinburgh universities, and entered the service of the East India Company as a surgeon in 1830. His chief interests, how-



Faldstool or portable Litany desk of carved oak

ever, were in palaeontology and botany: he discovered remains of mastodon and other fossils, experimented in tea-planting in India, introduced cinchona bark as a remedy for malaria, and discovered the asafoetida plant, used in medicine. Returning to England, he arranged the Indian fossils at the British Museum, 1844-47, and then returned to India as professor of botany and curator of the botanical gardens of Calcutta, where he worked until 1855. He died in London, Jan. 31, 1865.

Falconer, SIR ROBERT ALEXANDER (1867-1943). A Canadian scholar. Born Feb. 10, 1867, at Charlottetown, Prince Edward Island, he was the son of a Presbyterian minister. His education, begun in Trinidad, was continued at Edinburgh and German universities, after which, in 1892, he returned to Canada and was ordained in the Presbyterian ministry. In 1904 he was made principal of Pine Hill College, Halifax, and was president of Toronto university, 1907-32. He wrote *Citizenship in an Enlarging World*, 1928; *Immortality and Western Civilization*, 1930. Knighted 1917, he died Nov. 6, 1943.

Falconer, WILLIAM (1732-69). Scottish poet. Born at Edinburgh, Feb. 11, 1732, the son of a barber, he became a sailor, and wrote *The Shipwreck*, 1763, a realistic poem, and a *Marine Dictionary*, 1769. He joined the navy, and in Sept., 1769, sailed for India in the frigate *Aurora*, which was lost off Cape Town, with all hands.

Falconry. The sport of hawking and the breeding and training of hawks, more usually known as hawking (*q.v.*).

Faldstool (late Lat. *faldistorium*; Ger. *falten*, to fold, *Stuhl*, stool, seat, or throne). Portable

crossed or folding stool so constructed that it can be used as a *prie-dieu* or kneeling desk or a seat. In England it was used by bishops when occupying a seat in the sanctuary other than their throne, or when visiting a church other than their cathedral; and it is still used in Roman Catholic churches. The term is applied to the small, low desk at which the Litany is enjoined to be sung or said, and to the stool at which a sovereign kneels at his coronation. The *faldistorium* on which Queen Mary sat at her marriage with Philip II of Spain is preserved in Langton's chapel, Winchester Cathedral.

Falemé. River of Senegal. It forms part of the boundary between the Senegal and French Sudan colonies. It rises in French Guinea in the watershed separating the Gambia and Bafing rivers, and runs N.N.W. to enter the Senegal river near Bakel. Small boats can navigate part of it during the wet season. Length, 200 m.

Falerii. Ancient city, 35 m. N. of Rome, once a member of the league of 12 Etruscan cities. A place of great natural strength on the site of the present Civitá Castellana, it fell to Camillus c. 390 B.C., after the destruction of its ally Veii. After a rebellion in 241 B.C. the Faliscans were forced to leave their old city and build a new one, Falerii Novi, on low ground 3 m. to the N.W. The walls, towers, and gateways of Falerii Novi are among the best preserved examples of Roman town fortifications. It was deserted soon after 1000 A.D., its inhabitants reoccupying the older site.

Falernian Wine. Famous wine of the ancient Romans. It was light in colour and potent. A wine produced in the district, which is a fertile plain in Campania, near the Volturno river, is called Falerno.

Falguière, JEAN ALEXANDRE JOSEPH (1831-1900). A French sculptor and painter. Born at Toulouse, Sept. 7, 1831, he studied at the Beaux Arts under Jouffrey, and at Rome. His work was at first classical in manner, but afterwards became strongly realistic. A marble statue of Taroisus, boy martyr, now in the Luxembourg, was his crowning success; one may cite also the statue of Lafayette in Washington, a monument to Joan of Arc, a quadriga on the Arc de Triomphe, Paris, and a painting *The Wrestlers*. Falguière died April 19, 1900.

Faliero, MARINO (1279-1355). Doge of Venice. He defeated the Hungarians at Zara in 1346, and

captured the city. Elected doge in 1354, his troubles began with the defeat of the Venetian navy by the Genoese. The unrest caused by this disaster aroused Faliero's ambitions. He allied himself with the leaders of the populace, and a plot was hatched to murder the leaders of the nobility on April 15, 1355, and proclaim Marino prince of Venice. The Council of Ten, learning of the plot, seized Faliero, who confessed his share therein and was executed April 17.

Falkenhausen, FRIEDRICH, BARON VON (1869-1936). German soldier. He was born at Potsdam, and entering the army in 1887 had a distinguished career. He commanded the 6th army corps, 1916-17, and in April, 1917, succeeded von Bissing as governor-general of Belgium, where his rule was more oppressive than that of his predecessor. In the course of one year he had 170 Belgians shot, and he authorised severe penalties, deportations, and floggings. He died May 4, 1936.

During the Second Great War another von Falkenhausen, Alexander Ernst (b. 1878), nephew of Ludwig, came into prominence as military governor in Belgium and N. France, 1940-44. He had been a staff officer with the Turkish army in Palestine during the First Great War, and later was commander of the infantry school at Dresden, retiring 1930 as lieutenant. Anti-Nazi in his convictions, he served as head of a German military mission to Chiang Kai-shek, 1934-38, remaining as his adviser until recalled by Hitler to active service. Consistent opposition to the S.S. led to his dismissal and internment in a concentration camp shortly before the "July plot" of 1944. Released by British forces at the end of the war, he was held as a witness by U.S. authorities until 1947.

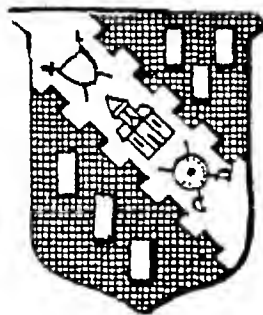
Falkenhayn, ERICH VON (1861-1922). German soldier. He was born at Burg Belchau, Sept. 11, 1861, and entered the army in 1880. After leaving the academy of war in Berlin in 1890 he joined the general staff. In 1913 he was appointed minister of war, which post he held at the outbreak of the First Great War; but in Dec., 1914, he was appointed chief of the

general staff, and was its responsible head till removed in Aug., 1916, owing to the failure of the German offensive at Verdun. Next month he was commander-in-chief of the 9th army, and launched the Rumanian campaign. He later went to the Middle East to direct the Turkish operations against the British in Palestine and Mesopotamia, but not being successful was recalled and replaced by Liman von Sanders in March, 1918. By many, Falkenhayn was regarded as the ablest strategist produced by Germany during the First Great War. He died April 8, 1922.

Falkenhorst, NIKOLAUS VON (b. 1885). German soldier. He commanded an army corps in the German invasion of Poland in 1939, and in 1940 was appointed commander-in-chief of the German occupation forces in Norway. In 1941 he was given command of the German armies in the N. sector of the Russian front, but after reverses in 1942 was relieved of his command. Sentence of death passed by a British war crimes court at Brunswick, Aug. 21, 1946, for having ordered the shooting of men of Commando units was commuted to 20 years' imprisonment. He was released July 13, 1953.

Falkirk. Burgh and market town of Stirlingshire, Scotland. It is 22 m. N.E. of Glasgow, and is served by rly. Falkirk, the boundary of which embraces the suburbs of Grahamston, Bainsford, and Camelon, is connected by rly.

with Grangemouth (3 m. N.E.), its port on the Firth of Forth, and is the centre of a busy ironworking and colliery district. The great Carron ordnance works was founded in 1760. Today the main manufactures are light castings, pipes, ranges, and stoves. Brewing, dis-



Falkirk arms



Falkirk. Parish church which in 1811 replaced the "Speckled Kirk" built 1057-93

tilling, tanning, and the manufacture of bricks, tiles, chemicals, and enamelled goods are flourishing industries. The famous cattle "trysts" or open sales, which were held thrice yearly, have been superseded by weekly markets (Tues.). At Westerglen is the B.B.C. Scottish regional transmitter. Falkirk became a burgh in 1600. Its first church was built by Malcolm III (Canmore). It is part of the burgh constituency called Stirling and Falkirk burghs. Pop. (1951) 37,528.

Falkirk, BATTLES OF. The first battle of Falkirk was fought, July 22, 1298. Under Edward I the English invaded Scotland to crush the rebellion of William Wallace. The two armies met near Falkirk. The Scots, mostly pikemen, were ranged in four circular groups, each ring surrounded by stakes. Between the groups were bowmen and behind a few horsemen. The English knights were in three columns, their traditional formation, flanked and backed by archers. The first line charged, only to flounder in a morass in front of the Scots; the second drove away the bowmen, but made no impression upon the pikes. Edward, therefore, called upon his archers, whose deadly aim soon broke the Scottish rings. The knights seized their advantage, and soon the Scots, greatly outnumbered, were either dead or in flight.

The second battle was fought between the English, under General Hawley, and the Jacobites, Jan. 17, 1746. Charles Edward, the Young Pretender, returning from Derby, found his way N. barred by the English. His Highlanders, in an impetuous charge, swept away the English troops, and Hawley lost 700 prisoners.

Falkland. Royal burgh of the co. of Fife, Scotland. It stands at the N. foot of East Lomond Hill, 36 miles by railway N. of Edinburgh. The chief attraction is its palace, formerly the residence of the dukes of Fife, in which David, the duke of Rothesay, heir to the Scottish throne, is said to have been starved to death at the instance of Albany, the regent, in 1402. The palace was a favourite residence of the Scottish monarchs; here James V sought refuge and died in 1542, and here Elizabeth (q.v.), daughter of James I, was born in 1596. Richard Cameron, founder of the Cameronians, was also a native. Rob Roy occupied the palace in 1715. It fell into decay, but was restored towards the end of the 19th century by the

3rd marquess of Bute. Weaving and linoleum making are carried on in the town. Pop. (1951) 1,039.

Falkland, LUCIUS CARY, 2ND VISCOUNT (c. 1609-43). English royalist. He was the son of Sir



Lucius Cary, 2nd Viscount Falkland
After Van Dyck

Henry Cary, a Devon man, who, after being lord deputy of Ireland, was made a Scottish peer as Lord Falkland in 1620. Lucius was educated at Trinity College, Dublin, and saw a little military service in the Netherlands. In 1633 he became Viscount Falkland, but by this time he had inherited from his grandfather, Sir Lawrence Tanfield, the estate of Great Tew, Oxon. His political career began in 1640 with his election as M.P. for Newport. He opposed the worse illegalities of the king, but was never a bitter partisan, and gradually, as the opposition to Charles hardened, he became more definitely on his side. In 1642 he was made a secretary of state. He was at Edgehill with Charles, but soon he fell into the melancholy described by Clarendon, seeing nothing but misery before his country. Expressing a wish to be "out of it ere night," he found the death he desired at Newbury, Sept. 20, 1643, when riding forward alone towards the foe.

Falkland is known mainly from the accounts given of him by his friend Clarendon, and these make him one of the most attractive men of his own or any age. He loved learning, and the society of scholars, who gathered in delightful freedom at his house; Chillingworth, Hales, Suckling, and Waller were among them. He wrote *A Discourse of Infallibility*. Of him Clarendon said, "Whosoever leads such a life need not care upon how short warning it be taken from him." The title passed to Falk-

land's eldest son, but his direct line died out in 1694. It then passed to Lucius (d. 1730), a descendant of the 1st viscount, the ancestor of the 13th viscount (Lucius Cary, b. 1880,) who succeeded 1922. *Consult* Life and Times, J. A. R. Marriott, 1907.

Falkland Islands. British crown colony in the S. Atlantic. The islands lie about 300 m. E. of the Strait of Magellan, and 1,000 m. S. of Montevideo. The group contains two large islands and about 100 small ones, with an estimated land area of about 4,618 sq. m., excluding S. Georgia, estimated at 1,000 sq. m. The chief are E. Falkland (2,580 sq. m.) and W. Falkland (2,038 sq. m.). The highest point is Mt. Adam (2,315 ft.) on W. Falkland. E. Falkland is hilly in the N., but low-lying, marshy, and boggy elsewhere. Trees are lacking, but grasses flourish; vegetables and green crops are cultivated. The coasts are much indented, affording good anchorage.

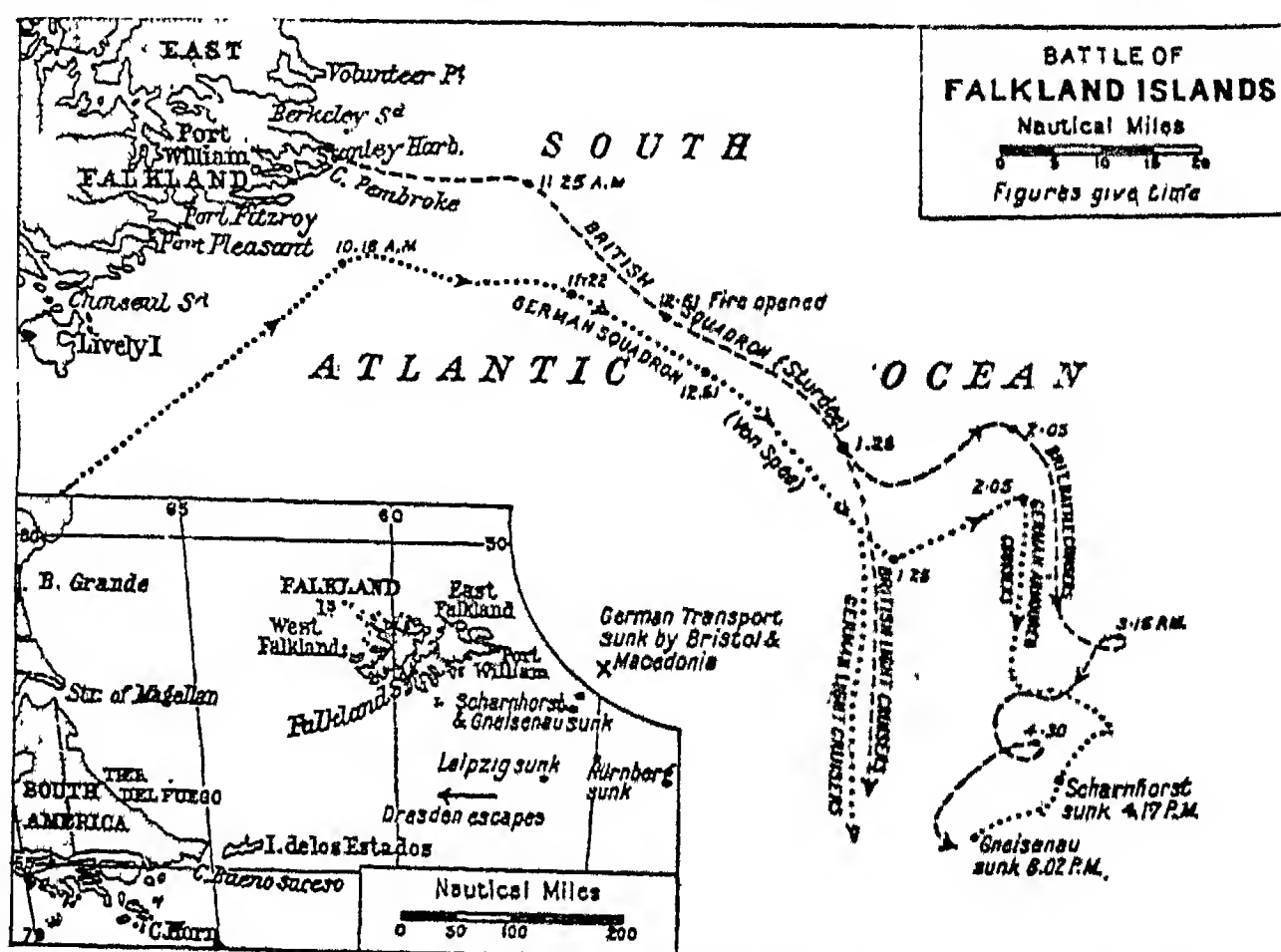
The chief industries are sheep-farming and whale fishing; horses and cattle are reared. Apart from the pastoral industry at the Falklands and the greatest whaling industry in the world, carried on in S. Georgia and other Antarctic dependencies of the Falkland Is., there are few enterprises of commercial value. The exports are wool, whale products, and guano. Stanley, the capital (pop. 1,252), is the only town; it is on E. Falkland, and possesses a good harbour. The climate in the Falklands, although bleak, is healthy. In the S. Orkneys, S. Shetlands, and Graham Land, the land is covered with

snow and glaciers, except in low-lying spots in the summer. There is an almost constant succession of strong winds, snowstorms, and fogs. The only indigenous mammals are the fox and mouse. Pop. of colony, including S. Georgia, est. (1954) 3,583.

The Falklands were discovered by John Davis in 1592, and taken by the French in 1764. The British recovered them 1767, lost them to the Spaniards, and recovered them again in 1832. Off these islands Sturdee won a naval victory over a German squadron in 1914 (*v.i.*).

Argentina from time to time claimed sovereignty over the Falkland Islands and its Antarctic dependencies; while Chile laid claim to the dependencies, and in 1948 both countries set up bases in the dependencies. They rejected the U.K.'s offer to submit the dispute to the international court of justice, but in 1949 the three govts. made an agreement, renewed annually, not to send warships S. of lat. 60° during the Antarctic summer, except for customary routine movements.

Falkland Islands, BATTLE OF THE. Naval engagement of the First Great War. It took place Dec. 8, 1914. The vessels engaged were on the one hand a German squadron under von Spee, consisting of the armoured cruisers *Scharnhorst* (flagship) and *Gneisenau*, the light cruisers *Nürnberg*, *Leipzig*, and *Dresden*, and three transports; on the British side, the battle cruisers *Invincible* and *Inflexible*, the armoured cruisers *Carnarvon*, *Cornwall*, and *Kent*, the light cruisers *Glasgow* and



Falkland Islands. Chart illustrating the course of the naval battle of Dec. 8, 1914. Inset, map showing position of the Falkland Islands relative to the mainland

Bristol, and two armed ships, all under Vice-Adm. Sturdee. The German squadron had recently destroyed two cruisers at Coronel (*q.v.*), and the two British battle cruisers were secretly dispatched to the Falklands to confront von Spee with overwhelming force.

The surprise was complete. While the British ships were coaling at Port William, von Spee, unaware of their presence, approached with the intention of seizing the naval base. On sighting the British battle cruisers (about 9.30 a.m.), the German squadron speedily turned about and set off E. at speed. At 10 the British ships put to sea in pursuit, with the Germans still in good view. The battle opened shortly before 1 p.m. The German light cruisers fled S., followed by the British cruisers. Sturdee engaged Scharnhorst and Gneisenau with the British battle cruisers in a running fight, going "all out" in a S.E. direction. Scharnhorst was sunk at 4.17 p.m. with no survivors. Gneisenau just before 6 p.m., with only 94 survivors. Leipzig and Nürnberg were sunk in separate actions. Dresden escaped for the time being, but the squadron as an active force was wiped out, the total German loss in men being 2,100. British losses were five killed and 16 wounded. *Consult* The Official History of the Great War, Vol. 1. Naval Operations, J. Corbett, 1920.

Fall, THE. Defection of the first human beings from a state of innocence. This is represented in the Eden story as an act of wilful disobedience, at the instigation of the serpent, to a command of God. As a consequence, Adam and Eve became conscious of guilt, and were expelled from the Garden of Eden. Theology teaches that the disobedience of our first parents had a threefold consequence in (1) a change of man's relation to God; (2) the loss of certain privileges connected with that relation; and (3) the beginning of a degenerative process which tended to make human nature more and more corrupt and alienated from God.

From this results the doctrine of original sin—that all men are born in a state of sin and are prone to wickedness as a result of Adam's fall. This may be viewed in two ways. Adam was the representative man and, with Eve, constituted the whole human family; so that the whole race fell in him. Or it may be viewed in connexion with theories of heredity, and sin be regarded as a mental

and moral tendency transmitted by natural generation. In any case, all orthodox theologians hold that original sin infected the race in all its individuals, and could be removed only by the act of God in Redemption through Christ.

In recent theological development there is a tendency to question the foundation on which the doctrine of original sin depends. This criticism rests on the following grounds: (1) the assumption that the human race started in a state of perfection is in conflict with the findings of modern anthropology and is difficult to reconcile with the doctrine of evolution; (2) the account of the Fall in Genesis does not contain the doctrine; (3) there is no definite trace of the doctrine in the rest of the O.T.; (4) the doctrine of original sin was the creation of the intermediate period between the O.T. and N.T., and first appears in Ecclesiasticus; (5) there is no hint of such a doctrine in the teaching of Jesus; (6) it is doubtful whether Paul accepted the full implication of the theory, though it must be admitted that there is one statement in his epistles (Rom. 5, v. 12) which seems to contain it; (7) the theory is difficult to reconcile with a true conception of Divine justice on the one side and human responsibility on the other. *See* Sin.

Falla, MANUEL DE (1876–1946). Spanish composer. He was born Nov. 23, 1876, and after studying in Madrid won the Spanish academy's prize for composition with an opera, *La Vida Breve*. During 1907–14 he lived in Paris, and then returned to Spain. His research on ancient folk-song influenced his own work, which developed an exclusively national manner. Ballets (*Love the Magician*, 1915, and *The Three-Cornered Hat*, 1919—the latter with choreography by Massine and settings by Picasso became a standard work of the Diaghilev company) were probably his most representative compositions. His other pieces included the impressionistic *Nights in the Gardens of Spain*, and *Pièces Espagnoles* for pianoforte. He died Nov. 14, 1946. *Pron.* Fah-yah. *Consult* Manuel de Falla and Spanish Music, J. B. Trend, 1930.

Fallacy (Lat. *fallax*, likely to deceive). An error in reasoning; a false argument that deceives or is intended to deceive. It may arise in the course of deduction or in the facts or observation on which reasoning is based. Thus, in the following argument, the

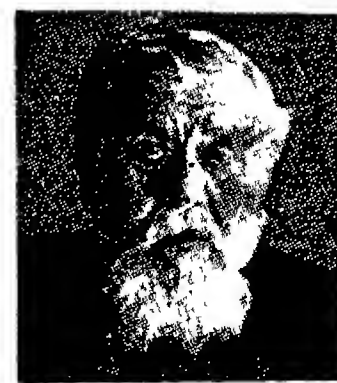
fallacy is obvious: Chimney-sweeps have black faces; that man has a black face; therefore he is a chimney-sweep. The fallacy is not so obvious in: We must keep out foreign goods, or our industries will be ruined. It took mankind thousands of years to appreciate the fallacy in the argument: As the sun rises in the east and sets in the west, it must revolve round the earth.

Particularly dangerous forms of fallacy are (a) "begging the question," or arguing in a circle, by assuming what has to be proved; (b) mistaking cause and effect; (c) thinking that because one event follows another, it must have been caused by it; (d) ambiguous use of words; (e) applying epithets, such as *disloyal*, *heretical*, *ridiculous*, to rebut statements. For a full classification of fallacies *consult* System of Logic (Book 5), J. S. Mill, 1843; Elementary Lessons in Logic, W. S. Jevons, 1870. *See also* Syllogism.

Fallada, HANS. Pen-name of Wilhelm Friedrich Rudolf Ditzen (1893–1947), a German novelist. He was born at Griefswald July 21, 1893. He won fame with a poignant study of post-war depression, *Kleiner Mann*—was nun? translated as *Little Man, What Now?* (1933). Other novels, all translated into English, are *Who once Eats out of the Tin Bowl*, 1934; *Once We Had a Child*, 1934; *Old Heart Goes A-Journeying*, 1936; *Wolf Among Wolves*, 1937; *Iron Gustav*, 1938. The juvenile element in Fallada's work was stimulated by the Nazi youth movement. A volume of fairy tales, *Hoppelpoppel, wo bist du?* was popular. Ditzen, who lived on a farm in Mecklenburg during the Second Great War, died Feb. 6, 1947.

Fallières, (CLÉMENT) ARMAND. (1841–1931). French president.

Born at Mézin, Lot-et-Garonne. Nov. 6, 1841, he studied law in Paris, and became a barrister at Nérac, for which he was elected Republican deputy, 1876. He was under-



Armand Fallières,
French president

secretary for the interior in Ferry's ministry, 1880, minister of the interior in 1882, 1887, 1889, of justice in 1887, of education 1883–1885, and president of the council in 1883. A senator in 1890, he was president of the senate 1899–1906.

He was elected president of France on Jan. 17, 1906, defeating Paul Doumer. Among the chief events of his term of office, which ended Jan. 7, 1913, were his visit to England in May, 1908, and the cementing of the Franco-Russian alliance. He died June 21, 1931. *Pron.* Fal-yair.

Falling Leaf. Evolution in aerobatics. The aircraft is made to start a spin in one direction, but just before the spin fully develops the controls are thrown over so that the machine is checked, pauses, and then side-slips over to start a spin in the opposite direction. The controls are again thrown over, reversing the spin once more, the evolution being repeated as often as the pilot desires. By alternating the spins the aircraft drops in the manner of a falling leaf.

Fallodon. Seat in Northumberland, England, of Viscount Grey (1862-1933). It lies about 6 m. N. of Alnwick. From Fallodon the statesman took part of his title; here he established a bird sanctuary; and here he died Sept. 7, 1933, leaving Fallodon to his nephew, Sir Cecil Graves, joint director-gen. of the B.B.C., 1942-1943.

Fallopian Tubes. Two tubes, one on each side of the uterus or womb, which convey the ova or eggs from the ovary to the uterus. Each tube is about 4 ins. in length. The inner end opens into the uterus near its superior angle. The outer end opens into the peritoneal cavity, and terminates in an extremity in close relation to the ovary, and bearing a number of fimbriae or fringe-like processes which, by some mechanism not fully understood, attract and catch the ovum as it leaves the ovary.

Fallopian OR **FALLOPIO**, GABRIELLO (1523-62). Italian physician and anatomist, discoverer of the functions of the Fallopian tubes (*v.s.*). Born at Modena, he studied medicine at Ferrara and other centres, becoming professor of anatomy at Ferrara. Afterwards he held the chairs of anatomy, surgery, and botany at Padua university, where he died Oct. 9, 1562. He published his *Observationes Anatomicae*, 1561, at Venice, where his works, *Opera Genuina Omnia*, were published in 1584.

Fallow. Term, derived probably from the Saxon *fealh*, a harrow, used to describe land that has been ploughed and harrowed but bearing no crop. The earliest rotation of crops was operated in the form of corn, fallow, since without cleaning it was impossible to

grow corn on land uninterruptedly year after year. Rotations persisted in this simple form until the introduction of more diversified crops such as turnips, swedes, and rotation grasses.

The beneficial effects of a fallow are biological, the ridding the land of weeds; physical, the improvement of the texture of the soil by the alternation of dryness and wetness; and chemical, arising from the accumulation of nitrates, and the liberation of mineral constituents such as phosphates and potash in a soluble form. Since the land is lost to cropping for a season when fallowed, the operation is an expensive one, and modern methods are designed to promote the cleanliness of land by cultivating crops which smother weed growth. In this category are rapes and kales, which are additionally valuable since they can be eaten off by stock, and thus not only keep weeds in check but enrich the soil, particularly when the stock receives concentrates in addition.

Fallow Deer. Small group of deer, which are characterised by having antlers round at the base and palmated above. They have small heads, rather large ears, and comparatively long tails, and usually stand about 3 ft. high. The hair is generally fawn colour, more or less dappled with white, but some local races lack the white spots, and are of such dark brown as to approach black. This is the deer generally kept in parks in Great Britain, and it occurs in a wild state in Epping Forest. It was probably introduced into Great Britain from the Mediterranean district at some early period. The huge extinct deer of Ireland, often erroneously called the Irish elk, was a gigantic species of fallow deer, and stood 6 ft. high at the shoulder, with antlers spanning over 11 ft. Its remains are also found in England and Scotland. *See* Deer; also Antler illus.

Fall River. City of Massachusetts, U.S.A. In Bristol co., it is a port of entry on Mount Hope Bay, 50 m. S.S.W. of Boston. It has an inter-urban electric rly. and a commodious harbour, with steamer connexion to New York and Philadelphia. Among the leading U.S. producers of cotton goods, it bleaches cloth and makes textile machinery, and also has oil refineries. Abundant water power is obtained from the Fall River and there is a hydro-electric plant on the Taunton. The first settlers received a grant from the Plymouth colony. Fall River was part

of Freetown until 1803, was called Troy until 1834, and received a city charter in 1854. Disastrous fires occurred in 1843 and 1928. Many French Canadians live in the city. Pop. (1950) 111,963.

Falls, CYRIL BENTHAM (b. 1888). British military historian. Educated at Bradfield College and London University, he served with distinction in the First Great War. During 1923-39 he held an appointment in the historical section (military branch) of the committee of imperial defence. One of his major works was the preparation of the official history of the land campaigns of 1914-18. He was Chichele professor of the history of war at Oxford University 1946-53. Falls, who was military correspondent to *The Times* from 1939 and a frequent broadcaster on the course of the Second Great War, published *The Nature of Modern Warfare*, 1941; *Ordeal by Battle*, 1943; *The Second Great War, a Short History*, 1948; *Elizabeth's Irish Wars*, 1950; *A Hundred Years of War*, 1953. He contributed to this Encyclopedia the article on the liberation of western Europe in the Second Great War.

Fallujah. Town of Iraq, standing on the Euphrates, about 40 m. W. of Bagdad. During operations against the Iraqi rebels in 1941 their transport was bombed at Fallujah on May 5. British troops occupied the town on May 19.

Falmouth. Bor., seaport, and former market town of Cornwall, England. It stands at the mouth of the Fal, 11½ m. S. of Truro, and has a station on a branch rly. It is a port of call, and has an excellent harbour, accessible to the largest vessels; the dry docks were in 1957



Falmouth arms

enlarged and developed to accommodate the largest tankers for repair. Ship repairing and marine engineering are the major industries.

Falmouth's equable climate, abundant sunshine, and the scenery of the Fal estuary and the surrounding countryside make it a popular holiday resort. Here are the headquarters of the Royal Cornwall Yacht Club, and all the usual holiday sports are catered for. The corporation maintains the public library and pleasure grounds. The town has an extensive promenade, tropical gardens, and a concert pavilion.



Falmouth. The harbour of this Cornish seaport and market town at the mouth of the River Fal

Near by is Pendennis Castle. Falmouth and Camborne is the name of a co. constituency. Market day, Sat. Pop. (1951) 16,975.

False Acacia (*Robinia pseud-acacia*) OR LOCUST-TREE. Tree of the family Leguminosae, native of N. America. It attains a height of 60–80 ft. Its long, narrow leaves are broken up into 5–12 pairs of oval leaflets, and at the base of the leafstalk are two stipules which, on the non-flowering branches, become hardened into persistent spines. The fragrant flowers are produced in long, pendent sprays, like those of the laburnum, but are white instead of yellow. The seed-pods, too, are like those of laburnum, but dark red in colour. The wood, though hard and durable, is liable to crack and is little used.

False Antiquities. Alleged relics of the human past forged, deliberately falsified, or erroneously attributed. The chief motives for their production are desire for gain and love of mystification. Production of copies of genuine originals (coins, scarabs, paintings, porcelain) with a fraudulent intention is on a different plane. To a special category should be referred such literary deceptions as Bertram's fabrication (see Bertram, Charles Julius). Among famous modern forgeries are those of Shapira, a Pole, who sold a collection of spurious Moabite pottery to the Prussian government for £3,000, and afterwards offered the British Museum an alleged Mosaic MS. on leather. The Louvre Museum, Paris, acquired, in 1896, for £8,000, a gold tiara inscribed to a Scythian king, Saitarpharnes, which was found in 1903 to have been produced in Odessa by a Russian workman. In 1908 scarabs recording the circumnavigation of Africa under Pharaoh Necho, led to a conviction for fraud. False prehistoric remains have fur-

nished the forger with a profitable field. Fifty years ago chipped flints were openly manufactured by Edward Simpson (Flint Jack). Meillet of Poitiers published grotesque Palaeolithic engravings in 1864.

Experts allow themselves sometimes by self-deception to attribute antiquity to

modern relics, as when W. Bode acquired for Berlin in 1909 a wax bust made by an English sculptor, Lucas, and claimed it as the work of Leonardo da Vinci. In 1947 a Dutch painter, H. van Meegeren (d. 1947), was imprisoned for passing off several of his own paintings as works by Vermeer (consult *The Vermeer Forgeries*, Jan Baesjou, 1956). See also *Imposture*; *Literary Forgery*. Consult *Archaeology and False Antiquities*, R. Munro, 1905.

False Bay. Inlet of the Atlantic Ocean, on the E. side of the Cape of Good Hope. The Cape of Good



False Acacia. Flower of the locust-tree of North America

Hope and Hangklip Cape form the W. and E. extremities. Its length is 22 m. and its breadth 23 m. On the western shore is Simonstown (*q.v.*), a major naval base.

False Point. Cape and port of India. In the Cuttack district of Orissa, the cape is on the Mahanadi estuary, and is situated in 20° 20' N. and 86° 47' E. It is so called from being mistaken by seamen for Point Palmyras, 1° farther N. The port (opened 1860) has the best harbour, safe and completely landlocked, between Bombay and Calcutta, and there is canal communication with the interior of Orissa.

False Pretences. Term used in English law. It is a misdemeanour by statute to obtain or attempt to obtain money or property by false pretences. The pretence must be false; it must be a statement of fact and not merely of intention; the person making it must know it to be false; by it the other person must be induced to part with the money, etc., and it must be done with intent to defraud. The pretence may be made otherwise than by words—*e.g.* a man in an undergraduate's cap and gown enters a shop in Oxford and obtains goods on credit. He has represented himself to be an undergraduate of the university. Maximum punishment is imprisonment for five years. Sentence of up to five years' penal servitude, or two years' imprisonment with hard labour, could formerly be passed for this offence.

False Relation. In harmony, one note following a different note of the same letter in another part, *e.g.* C sharp in alto followed by C natural in tenor, in successive chords. It is not permitted in strict harmony, but is condoned if, using the above example, both parts have C sharp in the first chord.

Falsetto (Ital.). Term applied to a kind of high voice of men who discard the natural pitch of speaking and singing in order to cultivate extreme high notes and sing an alto part. It is produced, according to some, by allowing only a short length and a portion of the breadth of the vocal cords to vibrate, instead of the whole. There are a few natural adult alto voices, but most choir singers who adopt this part are baritones or tenors, using their falsetto range.

Falsification. Term used in connexion with accounts. The falsification of accounts by a clerk or servant with intent to defraud is by English law a misdemeanour punishable by imprisonment. It is also an offence to falsify the service certificate of a seaman or soldier. Some forms of falsification come under the heading of forgery (*q.v.*).

Falstaff, SIR JOHN. Comic character of Shakespeare. He has the principal part in both the plays named after King Henry the Fourth, and in *The Merry Wives of Windsor*. In *Henry IV* (1) he is the companion of the prince who becomes Henry V, and leader of a crowd of rascals; in *Henry IV*, (2) though he dominates the action, he has only one scene with the prince and is finally rejected by him. Falstaff's death is related in *King Henry the Fifth*. The

Merry Wives of Windsor was written at the desire of Queen Elizabeth, who wished to see the fat knight in love; but the Falstaff here presented is a shadow of the original, who was assumed to have been modelled on Sir John Oldcastle (*q.v.*). For the wit which enables Falstaff triumphantly to carry off any situation, all his faults—cowardice, lying, drunkenness, grossness—are forgiven; he has "more flesh than another man, and therefore more frailty." He emerges as the supreme comic creation in English literature; "I am not only witty in myself, but the cause that wit is in other men." Notable interpreters of the part include Beerbohm Tree, George Robey, Robert Atkins, Ralph Richardson. Falstaff is the subject of operas by Verdi and Vaughan Williams (Sir John in Love) and a symphonic study by Elgar. Consult *The Fortunes of Falstaff*, J. Dover Wilson, 1943.

Falster. Island of Denmark. It lies to the S. of Zealand, between Moen on the E. and Maribo on the W., separated from them by narrow straits. It is 28 m. from N. to S., with a maximum width of 15 m. The surface is fairly level, but low and marshy near the coast, where malaria is endemic. The island is fertile and cultivated; stock-raising, dairy-farming, and agriculture are the principal occupations. Sugar-beet and fruit are the chief crops. The largest towns are Nykjöbing and Stubbekjöbing, connected by rly. Area 183 sq. m. Falster forms with Maribo a county. Pop. of island, 51,392.

Falun. This Swedish town is described under its alternative name Fahlum.

Faluns (Fr.). Series of loose, sandy shell-beds, of Miocene age. They occur in the Touraine area of the S.W. part of France. Of marine, shallow-water origin, they often contain numerous fossils.

Fama Clamosa (Lat., crying report). Term used in Scottish Church law for any public scandal against a minister with which the authorities find it necessary to deal. The charge must be maintained by some responsible person who is prepared to prove it, or it must be a matter of such notoriety that no special complainant is necessary.

Famagusta (Lat. *Fama Augusta*). Seaport of Cyprus. It stands on the E. coast, 3 m. S. of ancient Salamis. The cathedral of S. Nicolas and a castle are notable features of the town. The harbour improvements were finished in 1906, and a narrow gauge rly. con-

nects the town with Nicosia and Kalokhorio in the W. (71 m.). Agriculture is the chief occupation, and the town is noted for its pomegranates. The original Roman walls were strengthened by the Genoese and Venetians, and are still fairly well preserved. Here, in 1191, Guy de Lusignan (*q.v.*) was crowned king of Cyprus by Richard I. The town flourished under Venetian rule (1487–1571), but later was taken by the Turks, when its prosperity began to decline. An earthquake in 1735 destroyed it. Famagusta gives its name to an admin. dist. Pop. of town, 10,412.

Jews stopped while attempting to enter Palestine illegally were placed in a camp near Famagusta from Aug., 1946, and admitted gradually under the quota system until the British withdrew from Palestine, 1948. All who remained were admitted by Israel, the camp being cleared Feb. 10, 1949.

Famatina. Range of mts. in Argentina. An eastern portion of the Andes, in La Rioja prov. it rises to more than 20,000 ft. The town of Famatina is the headquarters of a mining region and is connected by rly. with Córdoba to the S.E.

Famatinite. Greyish copper mineral, copper antimony sulphide, often occurring intergrown with enargite, copper arsenic sulphide, in vein and replacement deposits; also associated with pyrite, tetrahedrite, chalcopyrite, barite, and quartz.

Famennian. Uppermost stage of the Devonian system of stratified rocks. It is well developed in Belgium and N. France, where it consists of fossiliferous shales and sandstones, and in Rhineland, where limestones also are developed. Beds of slate near Ashburton and the Petherwin beds near Dartmoor belong to this stage. The name is taken from the slates of Famenne (Belgium).

Familiar (Lat. *familiaris*). In the Roman Catholic Church, a person who belongs to the household of a pope or bishop. He must at least reside in the same diocese. The office became at one time an easy ladder to ordination and preferment. Consequently, the council of Trent decreed that a familiar could not be ordained by his bishop unless he belonged to the same diocese and had lived with him three years. Familiars of the Holy Office were officials of the Inquisition (*q.v.*) charged with the duty of arresting and imprisoning persons suspected of heresy or other offences against the spiritual authority. The name is explained

by reference to their admission into the confidence of the Holy Office, as members of the family.

Familiar was also the term applied to the spirit supposed to be in the service of necromancers and witches, incarnate sometimes in the form of a black cat or other animal. In this instance the idea was derived from the universal belief in a daemon, tutelar genius, or guardian angel associated with an individual from the moment of birth. See Demonology.

Famille Jaune (Fr.). Much of the finest old Chinese pottery is classified into family coloured groups, according to the predominating tints used. The most esteemed are the *famille rose*, *noire*, *jaune*, and *verte* (rose, black, yellow, green).

Family (Lat. *familia*). Group comprising father and mother, with their children. The unit of human society, its roots are traceable in the primeval life of mankind. The first attempt to elucidate the origin of family life was Maine's patriarchal theory (1861). Based on Roman models, it assumed that the primitive father possessed uncontrolled power, the *patria potestas*, over his household. This view was impugned by MacLennan (1865), who postulated a primeval promiscuity, out of which emerged matriarchy, attributed to uncertain paternity; and exogamy, due to the theoretic kinship of the maternal clan; while communal marriage ultimately broke up into polyandry and polygyny. Working on similar material Lewis Morgan (1870) observed that in primitive communities it was more customary to denote kinship by "classificatory" than by "descriptive" terms. The main classes were five in number, a man using the same words for all persons within the clan of the generations of his grandparents, parents, brothers, children, and grandchildren respectively. These systems were hailed as further evidence of a stage of communal marriage preceding the growth of family groups.

Westermarck (1891) reverted to Darwin's view (1871) that the family was from the beginning based upon the supremacy of the individual father. When the "matrimonial classes" of the Australian aborigines, based on the totem, were studied by Spencer and Gillen, Howitt, and others, they were held to point to a primitive form of group-marriage. Subsequently, Atkinson and Lang

(1903) suggested that the prohibition of marriage within an incest-group — whence exogamy sprang—was due to the jealousy of the sire. The theory of promiscuity is inconsistent with the evidence; the widespread variants of the normal family are explicable on other grounds.

In polygynous societies the family is composed of sub-families, which under the system of concubinage tend to become subordinate to that of the chief wife. The closer social relationship of the mother with her own children obscures the paternal status; one outcome of this is the toleration of union with the half-sister, *e.g.* Abraham and Sarah.

The matriarchal system, imposing rights and duties towards the child, first upon the kinship group, and afterwards, as their representative, upon the mother's brother, is widespread. It was found in Europe by the Aryan-speaking peoples who spread westward, bringing new conceptions of father-right that lay at the base of patriarchal society. Matriarchy was current in early Egypt, while patriarchy was well established at the dawn of Semitic history, which antedated the Aryan family.

In aboriginal America, where social organizations were developed on the Neolithic foundation brought from Eurasia, the family—in the sense of the homestead or "house-fire"—is traceable at every cultural level.

In societies which recognize the adoption of children, the term family connotes not only parents and their offspring but also adoptive parents and their adopted children.

Family. In classification of plants and animals, a group of genera which resemble one another but are not marked by such important distinctive features as to justify making them into an order. For example, the domestic dog belongs to the genus *Canis*, which, with three other living and several extinct genera, is included in the family Canidae, or dog-like mammals; this family forms a group of the order Carnivora. See Classification, table, pp. 2136-37.

Family Allowances. Term used for state assistance to families with children. France, in 1913, and Germany, in 1936, introduced such allowances, with the object of raising the birth rate. In the British Commonwealth they have found a place in social security schemes. Australia, under the

Child Endowment Act, from July 1, 1941, allowed 10s. a week for each child under 16 after the first (for which, from 1950, 5s. was allowed); New Zealand from April 1, 1946, allowed 10s. a week for each child under 16; Canada, from July 1, 1945, gave \$3 to \$8 a month for each child under 16 to families with under \$1,200 a year.

In the U.K. an act of 1945, effective Aug. 6, 1946, allowed 5s. (a sum revised from time to time) a week for each child after the first until July 31 following the 16th birthday of a child continuing full-time education. The ministry of national insurance administers the Act; payments are drawn at post offices. Where husband and wife live together, or a wife separated from her husband has the children, the allowance belongs to the wife. At the beginning of 1949 there were 2,900,000 families drawing allowances for 4,600,000 children. *Consult* Family Allowances, E. Rathbone, new ed. 1949.

Family Compact. Arrangements made in the 18th century between the kings of France and Spain for the maintenance of an alliance between them, the Bourbons being the family then ruling over both countries. On Nov. 7, 1733, France and Spain signed a secret treaty directed against Austria, with whom war quickly followed. In Oct., 1743, this alliance was renewed in a new family compact, directed mainly against Great Britain, with whom Spain, but not France, was then at war. War between French and British quickly followed. A third was made in 1761, when the Seven Years' War was raging. By this Spain entered the war.

The term family compact was applied to the domination of Upper Canada, or Ontario, by a narrow circle of men, attached to England and the English church, in the early 19th century.

Family of Love OR FAMILISTS. Religious sect, founded by Henry Niclaes, or Nicholas (*c.* 1502-80). Influenced by the mystical teachings of David Joris (1501-56), he claimed to be a recipient of divine revelations. The sect made its way to England in the reign of Edward VI, and had a few scattered followers. They taught that no one outside their sect could have a true knowledge of God; gave all the chief doctrines of Christianity a purely allegorical interpretation; and were extreme antinomians in practice as well as in theory. They became extinct about the middle of the 17th century.

Family Welfare Association.

Formed in London in 1869 as The Society for Organising Charitable Relief and Suppressing Mendicity. This name was later changed to Charity Organisation Society, and on Feb. 1, 1946, to Family Welfare Association. The chief work of the association is the development of family case work, which is the art of helping people in trouble to make the best use of their own capacities, with the cooperation of their family and the community, to overcome difficulties. It also seeks to unite in common action all persons and agencies engaged in family case work and to encourage developments necessary to meet new social needs. It takes an active part in social research and in practical schemes for raising the standard of living. Its London area committees maintain centres for social service representative of the life and work of the district. The offices are at Denison House, 296, Vauxhall Bridge Road, London, S.W.1.

Famine (*Lat. famēs, hunger*). Period of want or scarcity of food supplies, usually confined to a more or less restricted locality. Its chief primary cause is deficiency of rainfall, but floods, frosts, storms, visitations of insects or other pests, inadequate agricultural methods, ill-directed labour, deficient transport, and the ravages of war are contributory causes. Neglect in the storage of food frequently brings about famine among primitive peoples, but it is sometimes to be accounted for by less obvious reasons, such as wholesale deforestation, which gives rise to local conditions of drought, and the dependence of a group upon one kind of food, as maize in S. America, rice in China, or the potato in Ireland.

Although scarcity is only partially preventable, the careful organization and governmental supervision of agricultural production in most parts of Europe and America have virtually freed civilization from the dread of starvation in normal circumstances. But all the foresight and accumulated experience of man is by no means equal to combating the conditions of serious dearth which follow prolonged hostilities. During and after both the Great Wars famine, or near famine, spread widely throughout Europe, especially in Russia, Germany, Austria, the Balkans, Czecho-Slovakia, and certain parts of France and Belgium.

The greatest recorded famines occurred at a fairly early period in

history, when the world was entirely dependent upon local and circumscribed supplies. In 439 B.C. Rome was visited by a famine so severe that thousands cast themselves into the Tiber. In Egypt famine lasted A.D. 1067-72, while in 1005 Saxon England, and eleven years later the whole of Europe, experienced a prolonged period of terrible dearth. Another great European famine occurred in 1162, driving the population in many countries to cannibalism and to brigandage. Ireland has frequently suffered from periods of scarcity, especially severe visitations occurring in 1491, 1822, and from 1846 to 1847, when the potato crop failed with consequences of the most disastrous kind, thousands perishing from the "famine fever" which followed. In the period of dearth which followed the Thirty Years' War in Germany multitudes perished from hunger.

One of the most disastrous famines in modern Europe was in Russia in 1921. At the height of the shortage caused by agricultural disruption following the revolution, a quarter of the Russian people were on the verge of starvation. An American relief administration expended £12,000,000 in providing and distributing 800,000 tons of food amongst 10,500,000 people.

N. China suffered widespread famine in 1877-78 and in 1920. In India a million persons died of starvation in the famine of 1866 and

1½ millions in 1869, and the famine of 1899-1900 cost a million lives. A famine in Bengal in 1943, resulting from the failure of the Indian rice crop and the absence of supplies from Japanese-occupied countries, raised the death rate nearly 688,000 above the average, through starvation and the resultant cholera epidemic.

Fämund OR FAEMUND. Lake of Norway, in Hedmark co., near the Swedish border. It lies in a mountainous district, at an alt. of 2,199 ft., 85 m. S.S.E. of Trondhjem. It is 37 m. long from N. to S., with a maximum width of 5 m.

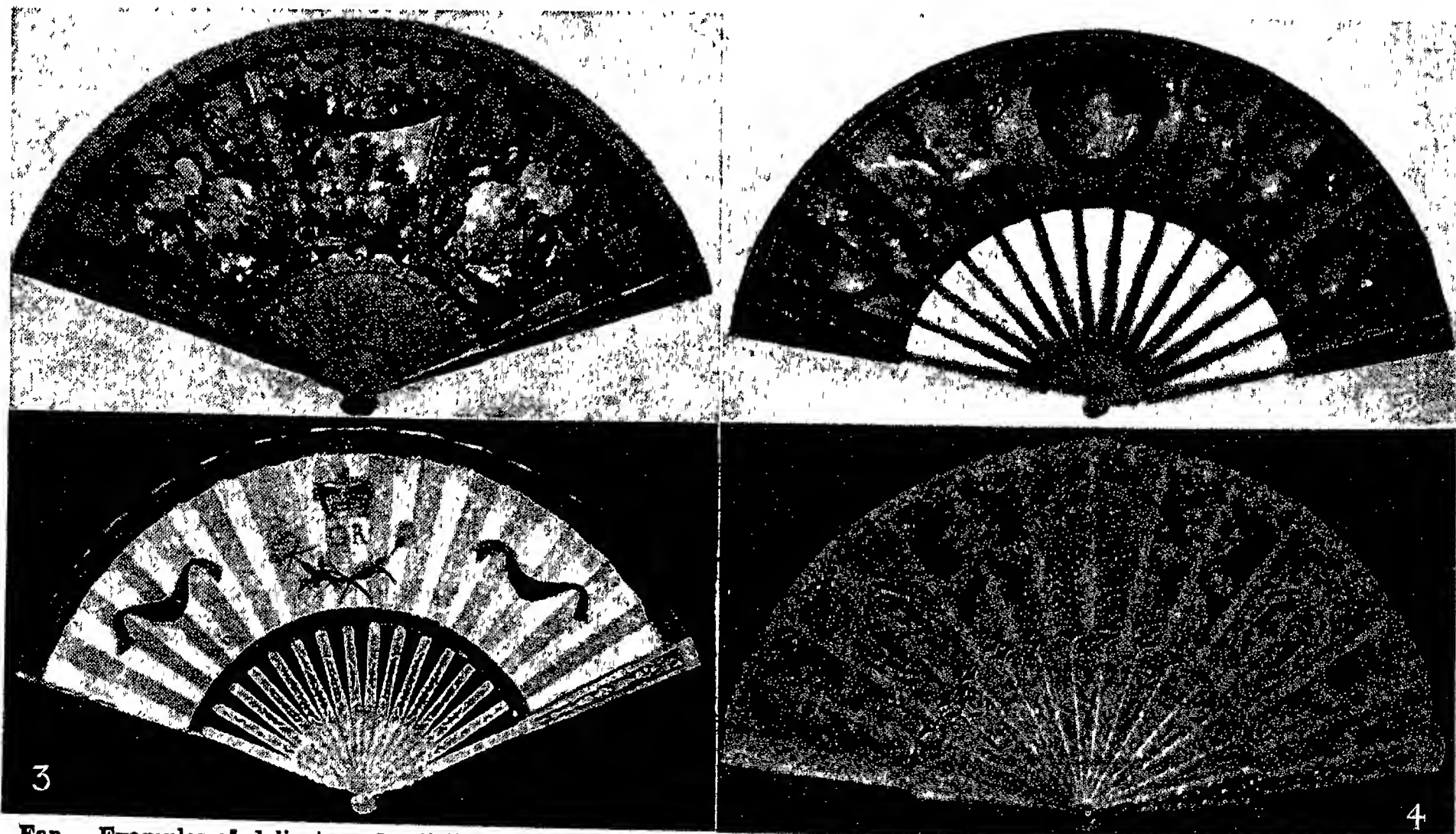
Fan (Lat. *vannus*). Implement for agitating the air, especially used for cooling the face. Fans have been used from the earliest ages in hot countries, and in their primitive form they were made of feathers stuck into long handles. In Europe they came into general use in the 16th century, and were known as early as the 14th century, having probably been introduced from the East. They were usually made of feathers, straw, silk, etc., with handles of ivory, gold, silver, and wood, often richly carved and encrusted with precious stones.

The folding fan, an invention of the Japanese, was adopted in Europe towards the end of the 16th century. Fan painting became an art in the middle of the 17th century, and printed fans, illustrating pastoral scenes, and reference to politics, etc., also became the

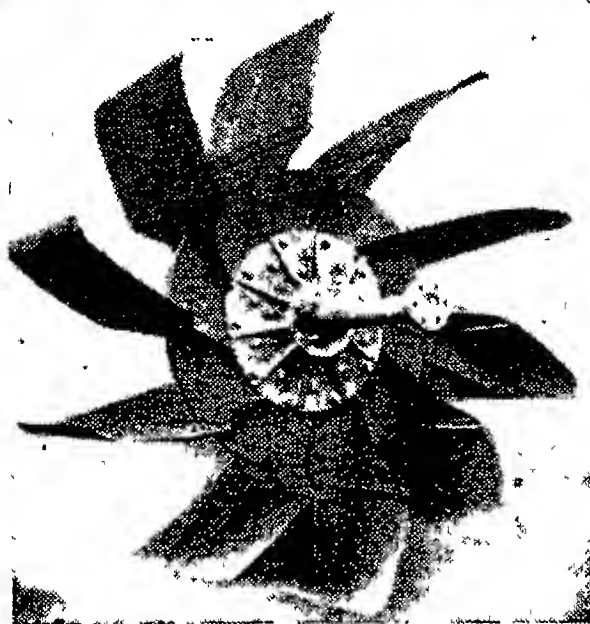
vogue. Fans have always played a symbolic part in ceremonial, and even now are used in the East, and are carried on state occasions in papal processions in Rome. See *Punkah*: consult also *Fans and Fan Leaves*, collected and described by Lady C. Schreiber (English), 1888 and (Foreign) 1890; *History of the Fan*, G. W. Rhead, 1910.

FAN PAINTING. Both folding and non-folding fans have been the object of elaborate decoration. Antoine Watteau, Nicolas Lancret, Jean Baptiste, Joseph Pater, François Boucher, and other 18th century French artists produced fans of incomparable beauty. Among English artists who have practised the art the most notable was Charles Conder (1868-1909), who in this genre was no mean rival of Watteau himself.

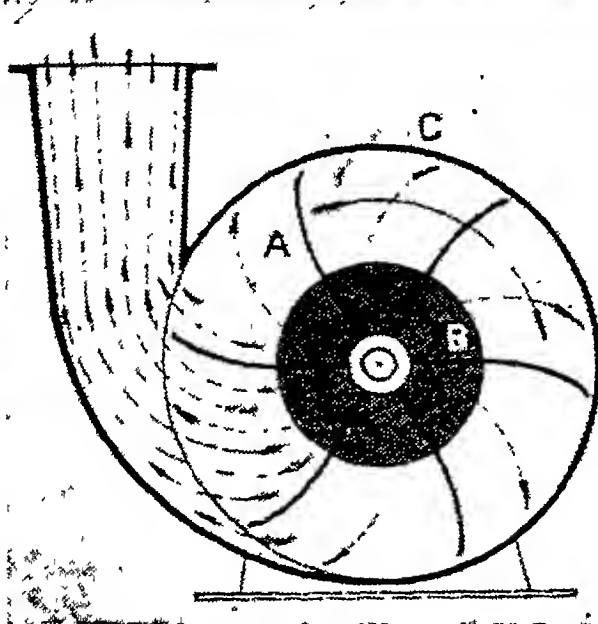
Fan. Mechanical appliance for moving air or other gas. There are two main types: the propeller fan, resembling in shape and principle a screw propeller; and the centrifugal fan. Fans are used to move air for ventilation purposes (e.g. the small portable electric fan which sets up a current of air within a room); or (extractor fans) to withdraw used air from a public building. These duties are performed by propeller type fans when little resistance to the flow of air from them is likely, since this kind of fan mainly speeds up the flow of air and does not greatly increase its pressure.



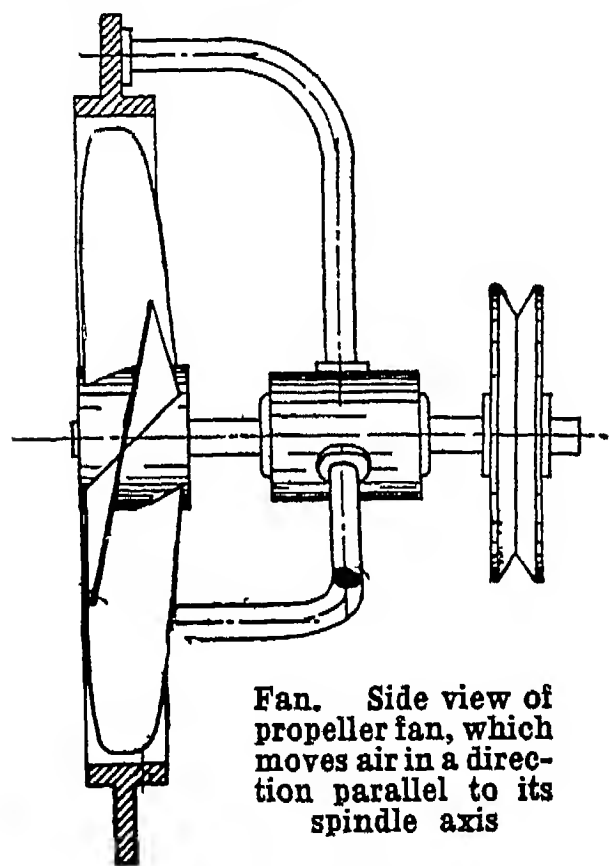
Fan. Examples of delicate and artistic work. 1. Richly painted gilt fan, decorated in Vernis Martin lacquer, period of Louis XIV, formerly belonging to Queen Victoria. 2. Silk fan with medallions painted by F. Boucher (1708-70). The ivory stick is carved and enriched with gold. 3. English fan made to commemorate the recovery from illness of George III in 1789, now in the British Museum. 4. White lace fan mounted on mother-of-pearl, formerly belonging to the Empress Eugénie



Fan. Standard centrifugal ventilating fan and, right, sectional diagram. A, fan-wheel; B, air-inlet; C, casing; course of air indicated by arrows



Centrifugal fans are installed when there is considerable resistance to be overcome (e.g. when the ventilating system includes lengths of duct or trunking, through which the air must be forced on its way to or from a building). Whereas in a propeller



Fan. Side view of propeller fan, which moves air in a direction parallel to its spindle axis

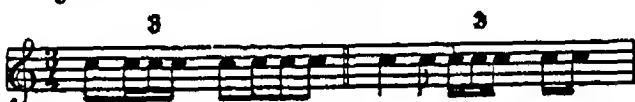
type fan the air is discharged in a direction parallel to the axis or spindle of the fan, in the centrifugal fan the air is drawn in axially at the centre and discharged at the periphery. The blades are curved and are enclosed in a casing of volute shape. In mechanical ventilation systems the spent air is usually removed by extraction, so inducing a flow of fresh air from outside through the many apertures at doors and windows. Fans are also used to force air into rooms, or to provide a forced draught to a furnace. See Boiler; Draught; Ventilation.

Fanariotes OR PHANARIOTES. Name given to the aristocratic Greek class in Constantinople (Istanbul) prominent during the 18th century as governors of the E. European provinces of the Porte. The word is derived from

Fanar, the Turkish name for that quarter of Constantinople which was inhabited by Greek residents. Members of this class, by means of a recognized system of bribery, obtained nomination as rulers of principalities such as Wallachia, and set themselves to recoup their expenses by unscrupulous taxation. The system of appointing fanariotes was dropped in 1821.

Fancy. Shortened form of phantasy. It means primarily any creation of the imagination. From this it came to be used for an inclination or liking, and thus we speak of fancying anything, and have the phrase bird fancier. The fancy is sometimes a term for followers of pugilism, while De Quincey uses it for lovers of rare books. Fancy goods as a trade term refers to the lighter and supplementary forms of women's dress, such as ribbons, gloves, veilings, etc., also to hand-bags and articles used to ornament rooms, such as silver vases, picture frames, and the like and to various "gadgets" suitable for presents.

Fandango. Spanish dance. It is usually accompanied by castanets to reinforce the strong rhythm, as well as by melodic instruments. It is danced by two people to triple time. A characteristic rhythm of the music is:



See Castanets.

Fanfare (Fr.) OR FLOURISH. Properly, a short passage for trumpets in unison, performed on state occasions. That used at the opening of parliament dates from the reign of Charles II. Some com-



Fanfare sounded by state trumpeters

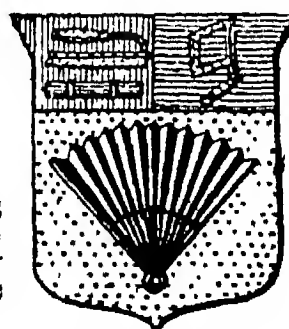
posers have used fanfares in opera, notably Beethoven, Spontini, Ambroise Thomas, and Wagner.

Fang. A specialised tooth in poisonous snakes by which the venom is conveyed into the wound caused by the bite. In the viper tribe the fangs are channelled, so that the venom, exuding from the tip of the tooth, is conveyed to the deepest part of the wound. In certain other snakes the fang is simply grooved, and most of the venom merely reaches the surface. The fangs may be either at the front of the jaw or at the back. The fangs usually fold back against the jaw when not in use. The venom is forced through the fang partly by constriction of the venom bag, partly by pressure on the base of the fang in the act of biting.

Fang OR PANGWE. Negro tribe of Bantu speech of Gabun and Spanish Guinea, living within the coast-highland region bounded by the Ogowe, Ivindo, and Campos rivers. They are thought to have migrated from the valleys of the N. Congo affluents about 1850, driving the weaker aboriginal Negroes before them. They use cross-bows and throwing-knives, and are adept potters and iron-workers. The men wear bark waistcloths, the women grass girdles.

Fanmakers' Company. London city livery company, incorporated on April 19, 1709. Its address is St. Botolph's Hall, Bishopsgate, E.C.2. It awards a silver medal and money prize to the best student of the year of the fan-engineering section of the national college of heating; the Latchford prize, open to art students for a design for a painted fan; and a scholarship for wind-tunnel or other aeronautical research at the Royal Aeronautical College.

Fannich, Loch of Ross and Cromarty, Scotland, 6½ m. by 1 m., drained by Fannich Water, 6½ m. long. The Fannich Mts. (highest peak Sgurr Mor, 3,637 ft.) and Fannich Forest (20,000 acres) lie to the N. of the loch. Under the



Fanmakers' Company arms

North of Scotland Hydro-Electric Board construction scheme, work commenced in 1946 to utilise Loch Fannich as a reservoir to feed a power station at Grudie Bridge in Strath Bran.

Fanning. A coral island in the Pacific Ocean, lying due S. of the Hawaiian Islands in lat. 3° 50' N. and long. 159° 20' W. Administratively it is annexed to the Gilbert and Ellice Islands Colony, and is a station of the submarine cable between Australia and Vancouver. It exports mother-of-pearl, and there are guano deposits. Area, 15 sq. m. Pop. 255. The name is also applied to a neighbouring group, viz. Christmas, Jarvis, Washington, and Palmyra, the last being claimed by the U.S.A. The total land area is about 260 sq. m. They were discovered in 1798 by Edmund Fanning.

Fanning, EDMUND (1737-1818). American soldier. Born at Long Island, New York, he graduated at Yale in 1757. He became a lawyer in N. Carolina, and occupied various posts in the local government, where his malpractices and subservience to the home government earned for him unpopularity. In 1774 he was made surveyor-general, and in 1777 he raised a regiment to combat the revolution. Colonel in the British army in 1782 and governor of Prince Edward Island in 1787, he became major-general in 1794 and general in 1808. In those years he did some voyaging in the Pacific. He died in London, Feb. 28, 1818.

Fanning, JOHN THOMAS (1837-1911). American engineer. Born at Norwich, Conn., he was there educated. He became an engineer, but left his profession to serve the North in the Civil War. He was for nearly fifty years one of the leading authorities on hydraulics, being concerned in the construction of numerous waterworks and similar undertakings in the U.S.A. He was chief engineer of the water-power company at St. Anthony Falls. His Treatise on Hydraulic and Water Supply Engineering, 1877, was long the best American book on the subject.

Fannius, GAIUS (fl. 2nd century B.C.). Roman annalist. He served in Africa, where he and Tiberius Gracchus were the first to mount the walls of Carthage 146 B.C., and in Spain 142. Through the influence of Gaius Gracchus he obtained the consulship 122, but when the former proposed to confer full citizenship upon the Latins, Fannius opposed him in a famous speech. Orator, advocate,

and student of philosophy, Fannius was best known for his *Annales*, a history of Rome from the earliest days down to his own times. The work enjoyed a high reputation, and was used by Plutarch in his *Lives of the Gracchi*.

Fanö. Island of Denmark. It lies off the S.W. coast of Jutland, and its N.E. point faces Esbjerg on the mainland. It is 11 m. long and from 2 m. to 3 m. broad. There are three small towns on the island: Fanö, a health resort on the W. coast; Nordby, on the N.E. coast; and Sønderho, in the S. Fishing is the main industry. Area, 20 sq. m.

Fano (anc. *Fanum Fortunae*). Port and resort of Pesaro e Urbino prov., Italy. It stands on the Adriatic, 8 m. by rly. S.E. of Pesaro. It is almost enclosed by medieval walls, with the bastions facing the sea. Its cathedral and churches contained many pictures by old masters. During the Second Great War, the *campanili* (towers) of five of Fano's churches were mined and destroyed by the Germans, and several in their fall badly damaged the building to which they belonged. Fano was taken by Polish troops of the 5th army, Aug. 27, 1944. The town possesses a fine theatre, formerly a palace, the remains of a triumphal arch of Augustus, and a palace of the Malatesta (undamaged). Fishing is the chief occupation of the inhabitants, and there is trade in corn, oil, and silk. The old harbour has silted up, and shipping is now conducted through a canal to the sea. Here, in 1514, the first printing press with Arabic type was set up. Pop. (1951) 37,912.

Fan-palm (*Livistona*). Genus of trees of the family *Palmae*. They have very large, fan-shaped,



Fan-palm. Leaves of *Livistona chinensis*, a species from S. China

plaited leaves, and are natives of Eastern Asia, Malaya, and Australasia. The best-known species are *L. australis*, from Eastern Australia, and *L. chinensis*, from S. China.

Fanshawe, SIR RICHARD (1608-66). English diplomatist and writer. Born at Ware Park, Herts, he was



Sir R. Fanshawe, English diplomatist
After Harding

appointed in 1635 secretary to the embassy at Madrid. About 1644 he became secretary to the prince of Wales and in 1648 was made treasurer of the navy under Prince Rupert. He was created a baronet in 1650. After the Restoration he sat in Parliament for Cambridge university from 1661 until his death, and undertook various missions to Spain and Portugal. He translated the *Lusiads* of Camoens (in captivity after the battle of Worcester), 1655; and Guarini's *Pastor Fido*, 1647. He died June 26, 1666.

Fantaisistes. Group of French writers who, in reaction against symbolism and romanticism, continued the traditional vein of Gallic irony, deriving inspiration from Villon and from the *grotesques*, especially La Fontaine. Accomplished craftsmen, they eschewed the laxities of the modernists. Théodore de Banville and later Jules Laforgue and Paul Jean Toulet were forerunners of *fantaisisme*, and the most important figures in the group were Tristan Derème (b. 1889), Tristan Klingsor (b. 1874), Jean Marc Bernard (1881-1915), the Belgian Théo Varlet (1878-1938), Jean Pellerin (1885-1920), and Léon Véraene (b. 1885). Francis Carco (b. 1886) and Pierre MacOrlan (b. 1883) turned from poetry to the writing of realistic fiction.

Fan Tan. A Chinese gambling game. The implements for playing consist of a bowl full of beans or counters and an oblong card, placed on a table, the corners of which are numbered, or assumed to be numbered, from 1 to 4: the lower right hand corner being 1, the top right hand corner 2, the top and bottom left hand corners 3 and 4 respectively. Or in place of the card a corresponding oblong space is chalked upon the table. Bets are made upon these separate corners, which are decided by the banker taking a handful of beans or counters, and dividing them into fours; the number of odd pieces over deciding the winning number. If there is no remainder, No. 4 wins.

An American variety is played with an ordinary full pack of cards, by any number of players up to eight. One card is dealt to each player, the remainder forming

the stock and being placed face downwards upon the table. Each player contributes a fixed stake. Unless an ace has been dealt to him, each player draws a card from the stock in rotation until he obtains an ace; each time he fails to do so, paying an ante or stake, which continues until all four are drawn by one or other of the players. The aces are laid side by side as they are turned up, and the different suits are built upon them, from ace to king. The player who first gets rid of all his cards takes the pool. *See Gaming.*

Fantasia (Ital.). Musical composition in which strict form is not exacted, and everything is left to the "phantasy" of the composer. In different centuries and countries, this term and similar ones—fancy, fantasie, rhapsody, phantasy, etc.—have denoted greatly varying types of music, but all possessing the idea of freedom from the more formal designs of their periods and surroundings. These terms have covered alike the naïve old contrapuntal string trios of Orlando Gibbons (early 17th cent.), the monumental organ fantasias of J. S. Bach (early 18th cent.), and much worthless piano-forte music of the 19th century.

Fantasia. Film by Walt Disney, made in Hollywood, U.S.A., and shown in the U.K. in 1941. The artist's aim was to depict in coloured cartoons the stories, patterns, etc., suggested by listening to eight pieces of classical music: Bach's toccata and fugue in D minor, Tchaikovsky's Nutcracker suite, Dukas's Sorcerer's Apprentice, Stravinsky's Rite of Spring, Beethoven's sixth symphony, Ponchielli's Dance of the Hours, Moussorgsky's Night on the Bare Mountain, and Schubert's Ave Maria. The orchestra was conducted by Leopold Stokowski, and Deems Taylor spoke a commentary. Disney's imaginative powers were fully extended in creating themes which ranged from abstract design and fairylike beauty to broad comedy.

Fantastic Symphony. Composition by Berlioz (Op. 14). It has for sub-title *Épisode de la Vie d'un Artiste*, and is a notable example of telling a story in music. This story concerns a young musician who, having tried to poison himself with opium, is thrown into a highly nervous condition; his sensations and memories find utterance in the form of musical imagery. The image of the beloved recurs in idealised, then distorted form throughout

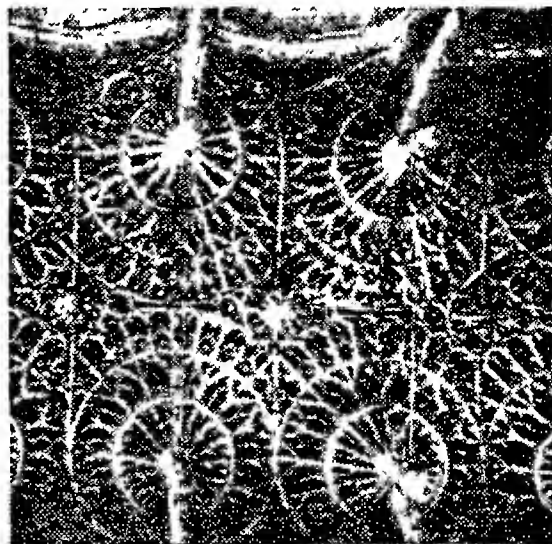
the five movements: Introduction, Un Bal, Scène aux Champs, Marche au Supplice, and Songe d'une Nuit de Sabbat. Reputed to have been inspired by Henrietta Smithson, the symphony was first played in Paris in 1832. It was performed as a ballet (with choreography by Massine) by the de Basil company at Covent Garden in 1936.

Fanti (cabbage-eaters). Confederacy of Negro peoples of Ghana (Gold Coast), West Africa, comprising the former native states of Abeasi, Abora, Anomabo, Kwaman, Mantresim, and Nkusukum. The Fanti, like the Ashanti, are Akan-speakers (Twi dialect subdivision), but their numbers are fewer. They are said to have arrived in their present coastal area from inland in the 17th century. Their tribal scars are three lines on each side of the jaw-bone.

Fantin-Latour, IGNACE HENRI JEAN THÉODORE (1836–1904). A French painter. Born at Grenoble, Jan. 14, 1836, he went to Paris to study at the Petit École. As a result of exhibiting three portraits in 1859 he became acquainted with Manet (whose portrait he painted), but remained uninfluenced by the new school. He combined realistic technique with the vision of a poet, and imbued his portraits with great fidelity. Many were of his friends, among them Baudelaire, Verlaine, Rimbaud, Whistler, grouped in such pictures as *Homage to Delacroix*, *The Corner of the Table*, *the Dubourg Family* (Louvre), and *Mr. and Mrs. Edwards* (National Gallery). Fantin-Latour was known as a great painter of flowers before his genius in portraiture was fully revealed. His cool, delicate colour and precision of construction are remarkable. A study of roses by him is in the National Gallery. The British Museum has a collection of his lithographs. He died at Buré, Orne, Aug. 28, 1904. A study of his art by F. Gibson appeared in 1924.



Fantin-Latour, French painter
Self-portrait in Uffizi Gallery, Florence



Fan-Tracery seen in the vaulting of Henry VII's Chapel, Westminster Abbey, begun in 1503

Fan-Tracery. In Perpendicular Gothic architecture, the rich tracery of a vault created by springing the stone ribs from their various points of support in such fashion that the effect is that of a spreading fan. There are finely developed examples in Henry VII's Chapel, Westminster Abbey, in St. Stephen's cloister at Westminster Hall, and in St. George's Chapel, Windsor. *See Gothic Architecture.*

Farad. The practical unit of electrical capacitance, or capacity. A capacitor is said to have a capacity of 1 farad when a charge of 1 coulomb raises the potential difference between its plates by 1 volt. The farad being an excessively large unit for practical purposes—the capacitance of the earth itself is only about 1/1400 farad—the practical unit of 10^{-6} farad, i.e. the micro-farad (μF) is normally used. An even smaller unit, the micro-micro-farad ($\mu\mu\text{F}$), or pico-farad, equal to 10^{-12} farad, is the order of capacitance which is common to radio-frequency circuits. *See Capacitance.*

Faraday, MICHAEL (1791–1867). British chemist and physicist. The son of a blacksmith, he was born at Newington Butts, London, Sept. 22, 1791. After a short apprenticeship with a book-binder, he became laboratory assistant to Sir Humphry Davy at the Royal Institution. There he quickly showed remarkable ability as an acute observer and original experimenter. In 1813–15 he travelled with Davy in Europe; ten years later he became director of the laboratory; and in 1833 Fullerian professor of the Institution for life.



Michael Faraday, British physicist

Faraday stands at the head of scientific observers of the 19th century, and his discoveries have left their indelible mark on the progress of mankind. Today his pointers to the paths of investigation in electricity are still being followed, and results are being obtained in accordance with his brilliant predictions. Faraday's

earliest work under Davy was concerned with chlorine, two new combinations of which he discovered. He followed this up with the liquefaction of a number of gases, and the discovery of new kinds of optical glass. The later discovery was destined to lead to one of his most important investigations in electricity, that of magnetic rotatory polarisation in 1846.

Ten years of experimenting led Faraday on Aug. 29, 1831, to the greatest of his discoveries—the induction of electric currents. A disk of copper rotated between the poles of a horseshoe magnet; two rubbing contacts closed the circuit; and a galvanometer registered the continuous current. In 1833 he proved the identity of electricity from different sources; in 1834 came the discovery of equivalents in electro-chemical decomposition; in 1838 electrostatic induction, followed by the announcement of the relation between electric and magnetic forces. These results were given to the world in Nov., 1841, when Faraday read his first lecture on experimental researches to the Royal Society.

His second great period of discovery began in 1845 when he returned to the problem of the effect of a magnetic or electric field on transparent bodies. He soon announced the magnetisation of light and the theory of diamagnetism. This was the end of his original work, but he continued to publish *Experimental Researches in Electricity* up to 1855; *Experimental Researches in Chemistry and Physics* appeared in 1859.

In 1835 Faraday was given a pension, and in 1858 a house at Hampton Court, where he died Aug. 25, 1867. Deeply religious, a member of the sect known as the Sandemanians, Faraday rigidly separated his religion from his science. In the latter, he was one of the most brilliant experimenters ever known, and to him must be given the credit for the solid foundation of electrical science as it is known today.

Bibliography. The standard *Life* is by John Tyndall, 5th ed. 1894. Other *Lives* are by Bence Jones, 1870; J. H. Gladstone, 1872; S. P. Thompson, 1898; W. L. Randell, 1924; E. W. Ashcroft, 1931; T. Martin, 1935. A *Tribute to Michael Faraday*, R. Appleyard, 1931. *Diary*, ed. T. Martin, 4 vols., 1932–33.

Faraday Building. Post office building in Queen Victoria St., London. Completed in May, 1933, and named after Michael Faraday, it

houses the London trunk telephone exchange, the toll exchange, the continental telephone exchange, and the overseas radio telephone exchange. Each year it handles 55,000,000 London and provincial toll calls; 1,300,000 continental calls; and over 100,000 overseas radio telephone calls. The four exchanges employ 3,500 operators and a staff of 600 engineers. During the Second Great War, Faraday Building twice received direct hits from bombs and was several times damaged by blast, but at no time were communications interrupted.

Faraday's Laws. These laws of electrolysis discovered by Michael Faraday are as follows: (1) In an electrolytic cell the amount of an ion liberated or deposited at an electrode is proportional to the quantity of electricity (*i.e.* electric current \times time) which has passed in a given time; and (2) the masses of substances liberated or deposited by the same quantity of electricity are proportional to their chemical equivalents. These quantitative laws permit of the measurement of the average electric current flowing in a given time through a circuit containing an electrolyte. See *Current*; *Electrolysis*.

Faraday Society. Founded in 1903, to promote the study of electrochemistry, electrometallurgy, chemical physics, metallography, and kindred subjects. Among its presidents have been Sir Joseph Swan, Sir Robert Hadfield, and Sir Robert Robertson. The offices are at 6, Gray's Inn Square, London, W.C.1.

Faradism. Term used in electrotherapeutics describing an interrupted current of electricity. Faradism is helpful in diagnosing the nature and extent of paralysis and in the treatment of many muscular conditions.

Farce (Fr. from Lat. *farcire*, to stuff). Dramatic piece of an essentially ridiculous character to which extravagant language, caricature, and ludicrous situations may all contribute. The modern farce is more closely connected with the ludicrous element that came to be grafted on to early morality plays, and in time came to be given in separate performances. In its modern sense it has been succinctly defined as the briefer sort of comic play in which a more unrestricted licence of fun is allowed, and a stronger demand made upon the sense of probability. A critic has also said that whereas characters in comedy are larger

than life, farce deals with real people in unreal situations.

Modern farce may be said to have started with the plays of Samuel Foote, in the 18th century. In the 19th century the short farcical play as written by Poole, Maddison Morton, F. C. Burnand, and others was highly popular. A series of farces by Ben Travers, at the Aldwych Theatre, 1925–33, provided some of the best examples in the 20th century. The word originally meant an interpolation, like an actor's gag, hence a performance in which jests and humorous incidents predominated.

Farcy (Lat. *farciminum*). Disease affecting horses. It is a form of glanders (*q.v.*), and as such must be notified to the local authorities.

Far East. General term for those parts of Asia farther east than the Indian sub-continent, that is, the Indo-Chinese and Malay peninsula, Indonesia, China, Japan, and the eastern R.S.F.S.R.

Far East, Soviet. Area of the R.S.F.S.R. lying along the Pacific coast, formerly called the Far Eastern Region. Its western boundary is formed by the Stanovoi and associated mountain ranges. The area comprises the Amur, Lower Amur, Kamchatka, and Sakhalin regions; and Khabarovsk and Maritime territories. Within Kamchatka region lie the Chukchi and Koryak national districts. Sakhalin region includes all Sakhalin and the Kurile Is., occupied by Russia after the Second Great War. The Amur and Anadyr, and upper reaches of the Kolima, are the principal rivers draining the Soviet Far East.

Fareham. Market town, seaport, and urban dist. of Hampshire, England. It stands on a creek off Portsmouth Harbour, 8 m. N.W. of Portsmouth, and is a rly. junction. The chief historic buildings are Place House and Porchester Castle. There is a trade in pottery, bricks, corn, and coal. In medieval times Fareham was a prosperous port, but now it can be reached only by small vessels. With Gosport it forms a bor. constituency. Market, Mon. Pop. (1951) 42,520.

Farewell. Cape of Greenland at its southernmost point, in lat. 59° 50' N. It is on a small island off the coast, with an alt. of 1,000 ft. The ice drifting past it from the N.E. towards Davis Strait, in addition to the currents, makes it dangerous for navigators.

Far from the Madding Crowd. Novel by Thomas Hardy, published 1874, one of his earliest

tales of rustic Wessex life. The central character is a woman farmer, Bathsheba Everdene, and the story tells of her tragic relations with three men. Gabriel Oak, in whose love she finds final repose, is a superb portrayal of fine and consistent loyalty.

Fargo. A city of N. Dakota, U.S.A., the co. seat of Cass co. The largest city in the state, it stands on the Red River of the North at the head of steamship navigation, 250 m. N.W. of Minneapolis, and is served by rlys. and an airport. Fargo and the surrounding area rest on the bed of the glacial Lake Agassiz, which is among the world's best wheat lands. Sweet clover has become an important crop here. Fargo is a distributing point for farm machinery and cars. It has meat packing plants and manufactures glass, wood, and steel products. Here is the state agricultural college. The town was settled in 1871 and incorporated four years later. Nearly half the people of the city claim Norwegian descent. Pop. (1950) 38,256.

Farida (b. 1920). Former wife of ex-King Farouk of Egypt. Daughter of Youssuf Zulfikar, a judge, and granddaughter of Said Mohammed, former premier, she married the king Jan. 20, 1938. He divorced her Nov. 17, 1948.

Faridkot. Former princely state of India, merged in 1948 in Patiala and E. Punjab Union, itself absorbed in Punjab 1956. Lying S. of Ferozepore it had an area of 643 sq. m. The ruling family belonged to the Sidhu-Barar clan of the Jats.

Faridpur. District and town of Eastern Pakistan, in Dacca division. The name is derived from a Mahomedan saint, Farid Shah, whose shrine has been set up in the town. The latter is on the right bank of the Ganges and is connected by rly. with Calcutta. Of the total area of the district, 2,821 sq. m., more than three-quarters is under cultivation. This swampy district grows much rice. Other crops are jute, which is the chief export, and pulses. Hand weaving is the principal industry. Pop. dist., 2,888,803; town, 17,450.

Faridun. Hero of Persian mythology. His story is told in the *Sháh-Námeh* of Firdusi (Eng. trans. A. Rogers, 1907). Faridun overcomes the dragon tyrant Zuhak and occupies the throne. He is said to have reigned justly for 500 years, and to have gone about the world doing good and planting cypresses and roses.

Farina (Lat., meal). Starchy preparation used for food or in the industrial arts. The food-products of cereal grains and pulses, and starchy stems, roots, and tubers, are collectively called farinaceous. Farina is defined under the U.S. Federal Food, Drug, and Cosmetic Act, 1938, as a wheat food product representing closely ground endosperm particles, sufficiently freed from bran and germ to give an ash content not exceeding 0.6 p.c. on a dry weather basis.

The farina used for sizing cotton textiles is principally potato starch, comprising normally starch 82.70 p.c., cellulose and ash 0.58 p.c., and water 16.72 p.c. It yields a thicker paste, and owing to its sparse nitrogenous matter is less liable to mildew than any other starch. It is mixed with wheat flour and china clay for stiffening fabrics, and because of its purity is the chief source of dextrin. Fossil farina or rock-meal is a white crumbly form of calcium carbonate.

Farinelli (1705-82). Professional name of the Italian singer Carlo Broschi. Born at Naples, Jan. 24, 1705, Broschi was a pupil of Porpora, in whose opera, *Eumene*, he made his first appearance in 1722. This made him famous, and procured him lucrative engagements in Vienna and London. In 1736 he went to Madrid and became a favourite of Philip V. There he remained for 25 years, being loaded with honours and exercising almost regal powers. His last years were passed at Bologna, and he died July 15, 1782. The exceptional beauty and range of Farinelli's voice and his wonderful control over it made him one of the most remarkable male sopranos who have ever lived.

Faringdon. Market town of Berkshire, England, known also as Great Faringdon. It is 17 m. S.W. of Oxford, and has a railway station. All Saints Church is a large building with brasses and other memorials; other buildings are the market hall and Faringdon House. The agricultural centre for a large district, Faringdon has a trade in corn, cattle, etc. Market day, Tues.

Faringdon, ALEXANDER HENDERSON, 1st BARON (1850-1934). British business man and politician. He was born in London, Sept. 28, 1850, became a stockbroker, and in time was head of the firm of Greenwood & Co. Having joined the board of the Great Central rly. in 1894, he became chairman in 1899, and deputy chairman of the L.N.E.R. in 1922. In 1898 he was returned to parliament as Unionist M.P. for West Staffordshire, but lost his seat in 1906. During 1913-16 Henderson was M.P. for St. George's, Westminster. In 1902 he was made a baronet and in 1916 a baron. On his death, March 17, 1934, the title passed to a grandson, Alexander (b. 1902).



Farinelli, Italian male soprano
From an engraving

Farington, JOSEPH (1747-1821). A British painter and diarist. Son of a clergyman, he was born at Leigh, Lancs, Nov. 21, 1747, and became a pupil of Richard Wilson. Elected R.A. in 1785, he is best known for two collections of engraved views of English lakes, published in 1789 and 1816 respectively. Farington was one of the first to recognize Constable's originality. He died at Didsbury, Dec. 30, 1821.

In 1921 the discovery of a diary (1793-1821) and note-books promoted him to fellowship with such diarists as Pepys and Evelyn. It was purchased and made public by *The Morning Post*, and, edited by J. Greig, was published in 8 vols., 1922-28.

Farini, LUIGI CARLO (1812-66). Italian statesman. Born at Russi, near Ravenna, Oct. 22, 1812, he early became an ardent nationalist, and in 1843 was banished from the papal states. On the election of Pius IX in 1846 he returned to Rome as secretary to the ministry of the interior, and later was appointed to the department of public health. On the declaration of the Roman republic, 1849, he resigned, but, disappointed at the trend of Pius's policy, Farini went to Turin, and wrote in 1851 his famous *Lo Stato Romano dal 1815 al 1850*. The same year he became minister of public instruction and an ardent supporter of Cavour, creating a deep impression by his letters to Gladstone on Italian problems. In 1859 Farini was sent as Piedmontese commissioner to Modena, became dictator of the duchy, and negotiated the transfer of Modena, Parma, and Tuscany to



Luigi Farini,
Italian statesman

Piedmont. Appointed minister of the interior. 1860, he became premier of the new kingdom of Italy 1861-63, and died Aug. 1, 1866.

Farjeon. Name of a family of British writers and musicians. Benjamin Leopold Farjeon (1838-1903), journalist and novelist, was born in London of Jewish descent. He emigrated and founded at Dunedin in 1861 the first newspaper published in New Zealand. Returning to London, he published *Grif*, 1870; his later novels, popular in their day, dealt chiefly with mysteries and detection of crime. He died July 23, 1903. He married Margaret (1853-1933), daughter of the American character actor, Joseph Jefferson, and descendant of the U.S. president, Thomas Jefferson. Of their four children:

Harry (1878-1948), born May 6, 1878, studied at the R.A.M., at which he became professor of harmony and composition, 1903. His compositions included a piano concerto; symphony in D; idyll for oboe and orchestra; symphonic poem, *Summer Vision*; choral works and songs. He died Dec. 29, 1948.

Eleanor, born Feb. 13, 1881 made her reputation with light verse. *Nursery Rhymes of London Town* established her as a writer of whimsical imagination and originality. *Martin Pippin in the Apple Orchard* was one of the most popular of her fantasies, and in her autobiographical *A Nursery in the Nineties*, 1935, she gave an intimate picture of the early life of herself and her brothers.

Joseph Jefferson (1883-1955) wrote successful crime novels

and plays. His thrillers, No. 17, and *The Green Dragon*, were dramatised, and his later books included *Underground*, *The Z Murders*, *Trunk Call*. A number of his stories and serials were broadcast.

Herbert (1887-1945) was born March 5, 1887. As journalist and dramatic critic he wrote for the *Daily Herald*, 1919-23; the *Daily Express*, 1923; *Vogue*, 1921-23, and 1927-35. As a dramatist he first achieved fame with *Advertising April*, 1923, and, in collaboration with his sister Eleanor, wrote revues and light operettas, notable for their wit and delicate satire: *The Two Bouquets*, 1936; *Nine Sharp*, 1938; *An Elephant in Arcady*, 1939; *Light and Shade*, 1943. He presented a series of intimate revues (the *Little Revues*) at the Little Theatre, London, 1938-42. He died May 3, 1945.

Farley, JOHN MURPHY (1842-1918). Irish-American prelate. Born at Newton Hamilton, co. Armagh, April 20, 1842, he was educated in Monaghan, New York, and Rome. Ordained priest in 1870, he was assistant pastor of S. Peter's, New Brighton, Staten Island, 1870-72; secretary to Archbishop M'Closkey, 1872-84; private chamberlain to Leo XIII, 1884; vicar-general, New York diocese, 1891; and domestic prelate to Leo XIII, 1892. Consecrated auxiliary bishop of New York, 1895, he became archbishop of New York, 1902, was made a cardinal, 1911, and died Sept. 17, 1918. He wrote a *Life of Cardinal M'Closkey*, 1900.

efficiency increases with decreasing size of holding, and that there is an increase in output for market in spite of greater home consumption. This is due, at least in part, to the fact that labour per acre decreases as the size of holding increases. Capital invested in buildings per acre also decreases with size of holding.

In some countries and districts the farm buildings and dwelling houses are grouped together in hamlets or villages, and both livestock and machinery have to be taken out to the land which surrounds them. More commonly the buildings of a farm are isolated in the centre of the holding.

Different Types of Farms

The following are the chief kinds of farm to be found throughout the world: (1) general or mixed; (2) dairy; (3) purely arable; (4) horticultural; (5) specialist; (6) ranch, cattle, or sheep station; (7) hill sheep.

Family farms everywhere are usually general or mixed farms. Much of the food consumed by the livestock is grown on the holding, while their manure, returned to the land, helps to fertilise it, the mixed farm thus being the best means of keeping the land fertile. Current tendencies are, however, towards specialisation, and the farmer running a mixed farm, unless it is large enough to allow of specialist managers for its different branches, may fail, since he cannot well be a specialist in all branches.

The dairy farm is generally a special type of the mixed farm in which livestock is restricted to dairy cattle. Such a farm flourishes particularly if within easy reach of a large centre of population. Purely arable farms are to be found chiefly away from cities, and are often devoted to monoculture. In the past, it has not been uncommon for a farmer to crop virgin land continuously for several years without manuring and then, when its fertility has been seriously reduced, pass on to fresh virgin land. As the extent of virgin land decreases, and settlement increases, treatment with so-called artificial fertilisers, or other forms of manure, becomes essential.

Fruit, vegetables, flowers, and such special crops as rhubarb, watercress, herbs, etc., are the principal products of horticultural farms. It is sometimes difficult to differentiate between a farm and a market garden, but the horticultural farm proper has some livestock, and its crops, with the exception of trees, are grown in a

FARM: TYPES AND PRODUCTS

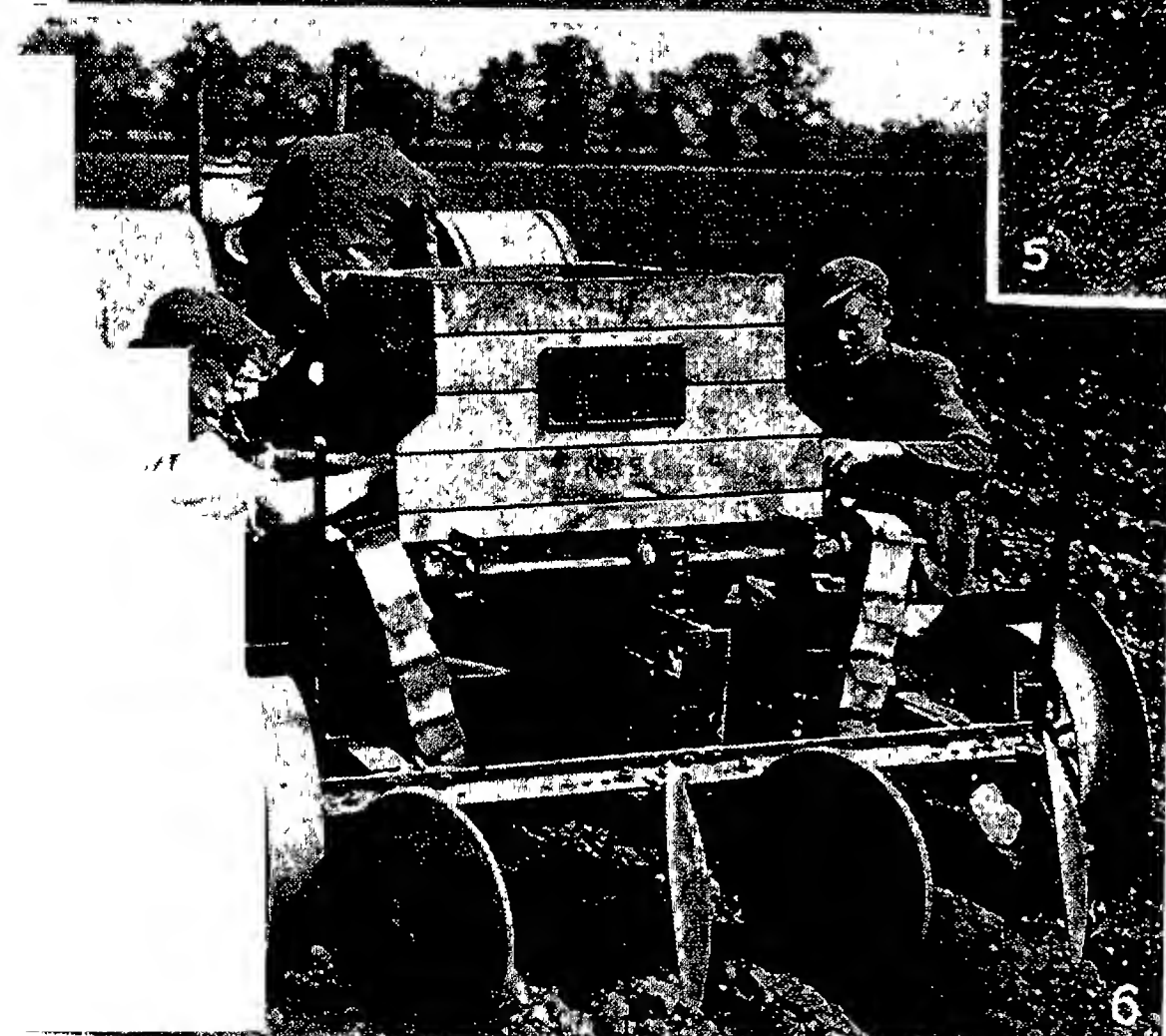
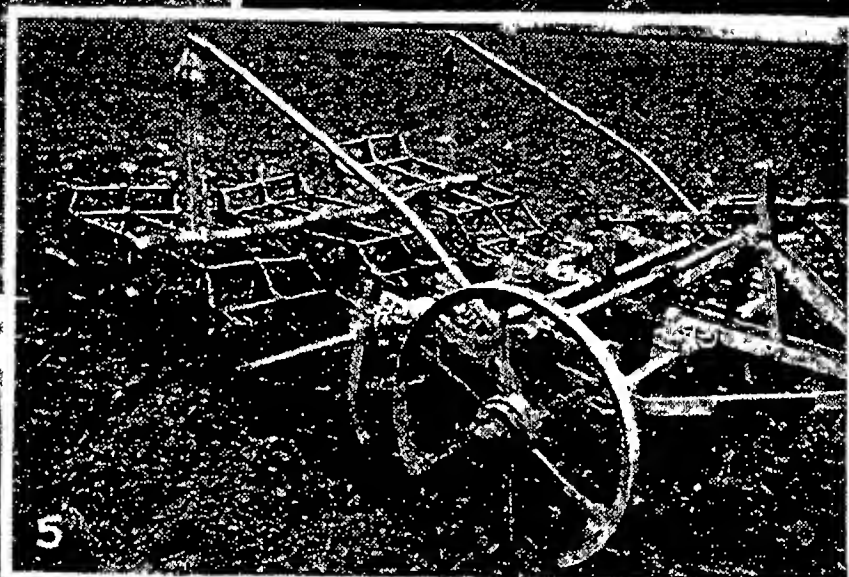
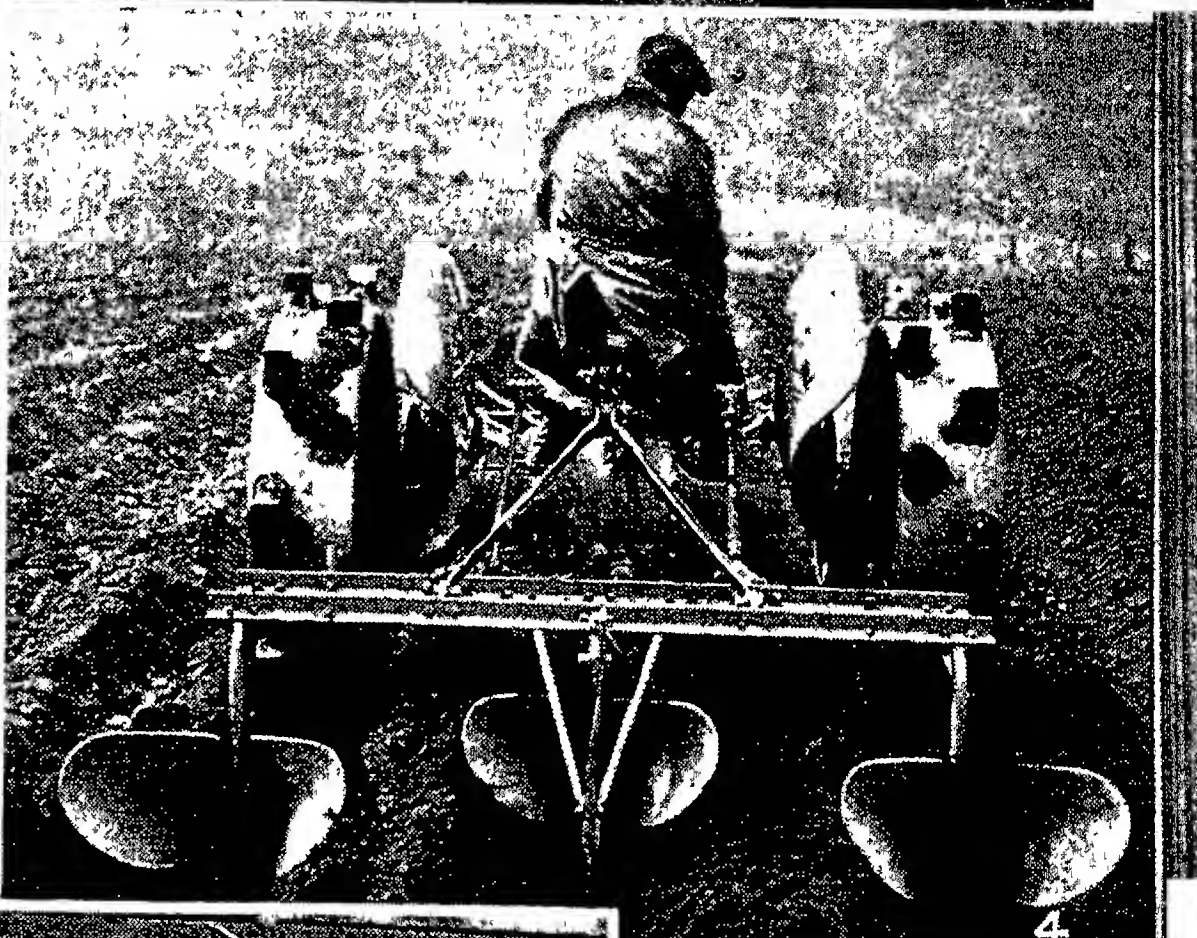
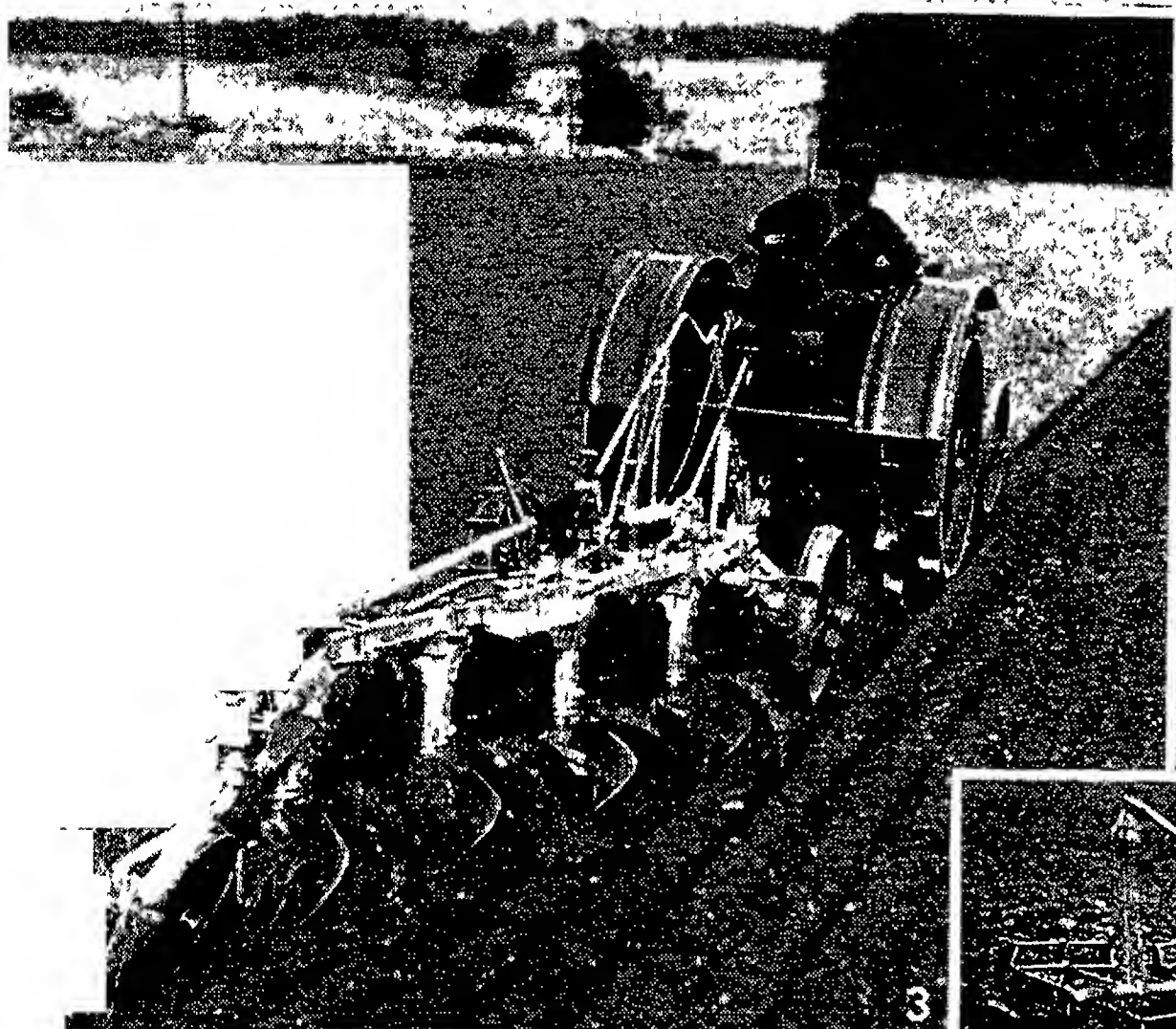
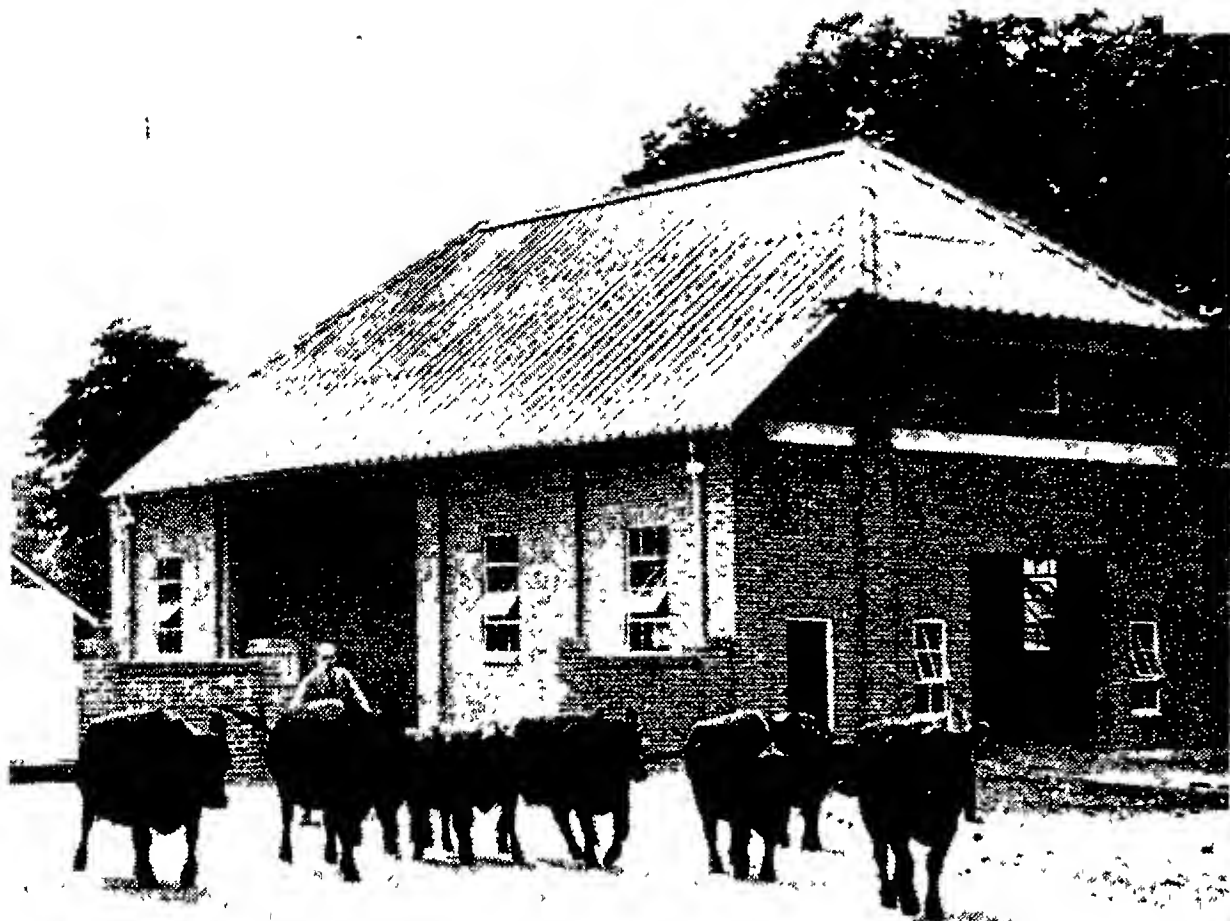
R. W. Haddon, Managing Editor, *Farmer & Stockbreeder*

Farm is a term covering a unit producing a wide variety of materials, but based always upon the land and its fertility. See also Agriculture; Crops; Monoculture; Rotation of Crops etc.

The farm is most simply defined as the unit of organized production from the land, whether the produce takes the form of crops for direct human consumption, of animal products, or of vegetable fibre for clothing and other purposes. It had its beginnings with the first development of settled human communities. The size and nature of the unit vary widely both according to the type of production concerned and the political structure within which land is held. The small holding of the Chinese or Indian peasant may be no more than an acre, while the ranches of America may extend up to 20,000 acres, and sheep and cattle stations in Australia up to

30,000 acres. In Soviet Russia, the large state farms average about 40,000 acres (see *Sovkhoz*), the collective farms about 1,200 acres (see *Kolkhoz*). The large arable estates of 1,000 acres upwards usual in central Europe up to the Second Great War were for the most part broken up immediately after it: e.g. in Hungary, where in 1938 thirty-six magnates owned over a million acres and the 1,200,000 peasants 950,000 acres between them, a decree of 1945 limited peasants' estates to 280 acres, others to 140.

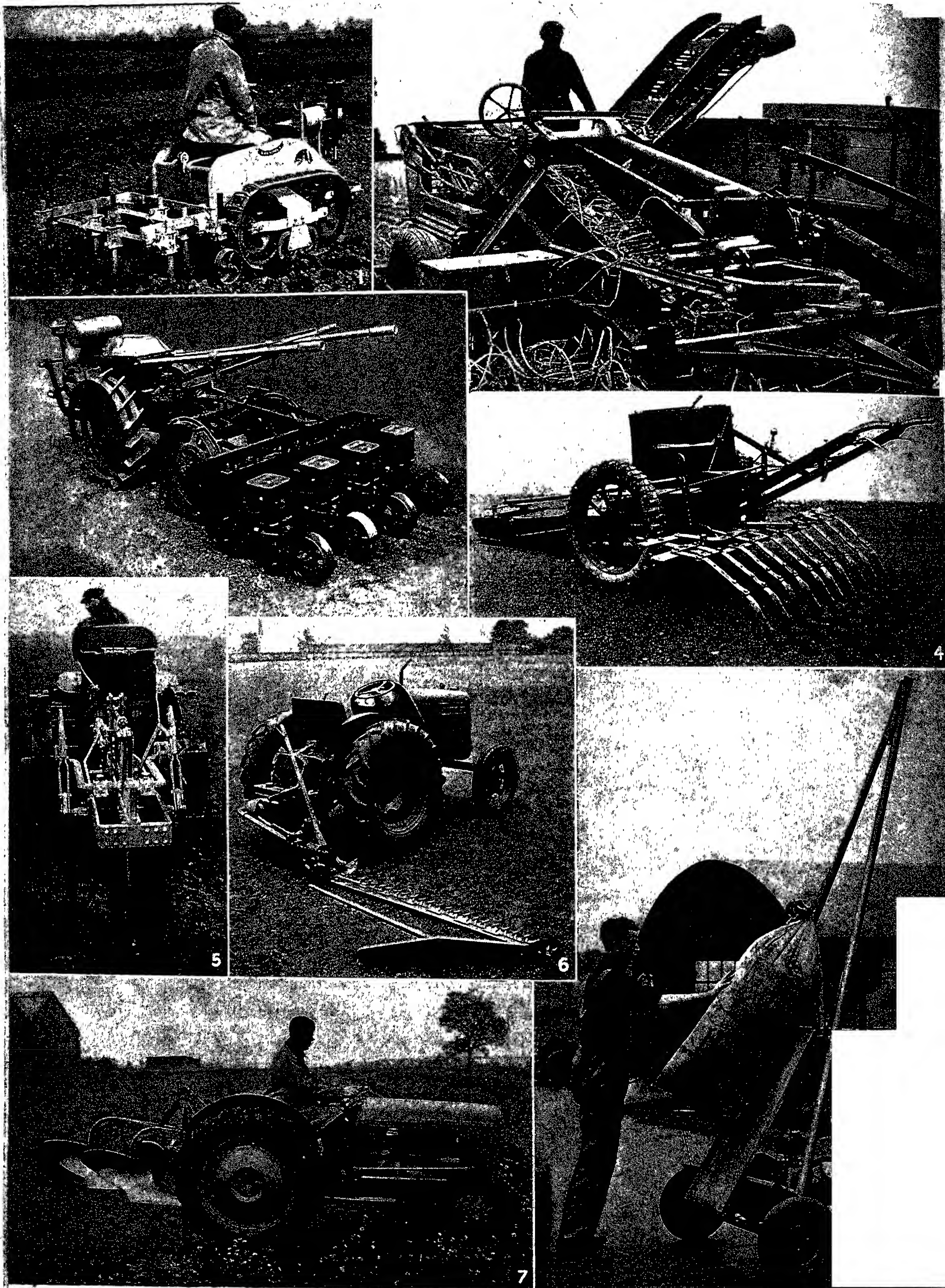
The majority of farms throughout the world are from 3 to 500 acres. It is generally accepted that, down to 10 acres, economic



1. Farm building at Ampthill, Bedfordshire. 2. Cattle shed with concrete floor and tubular stalls. 3. Four-furrow tractor-drawn plough. 4. Splitting back ridges in preparation for potato planting. 5. Drag harrow with

automatic lift attachment. 6. Potato planting machine, which sows and covers two rows of potatoes at one time. 7. Two-furrow one-way plough, constructed to plough 12 ins. deep and to subsoil 6 ins.

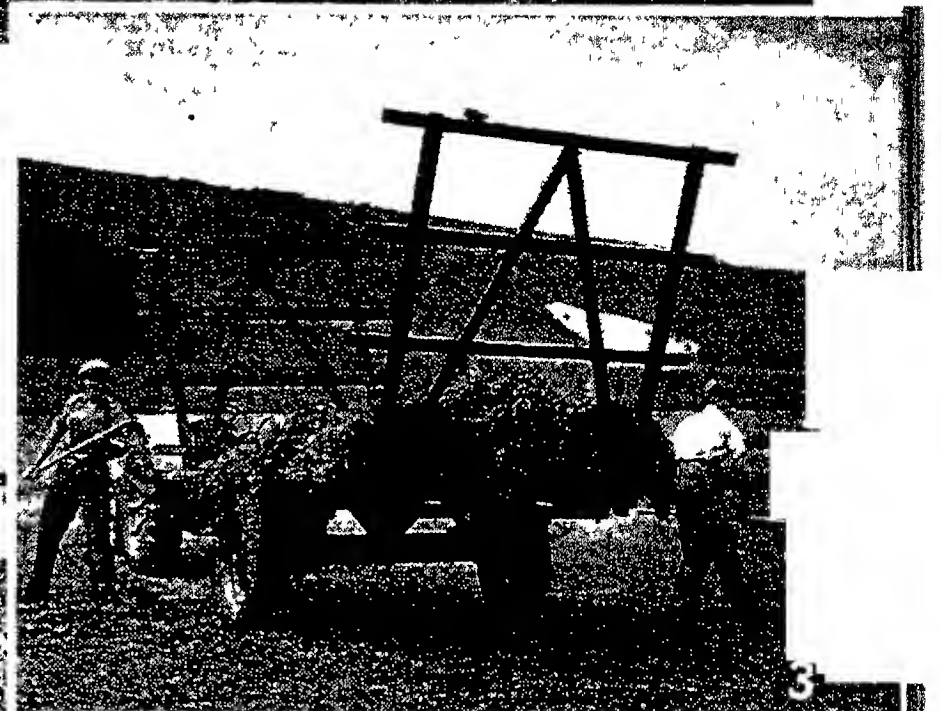
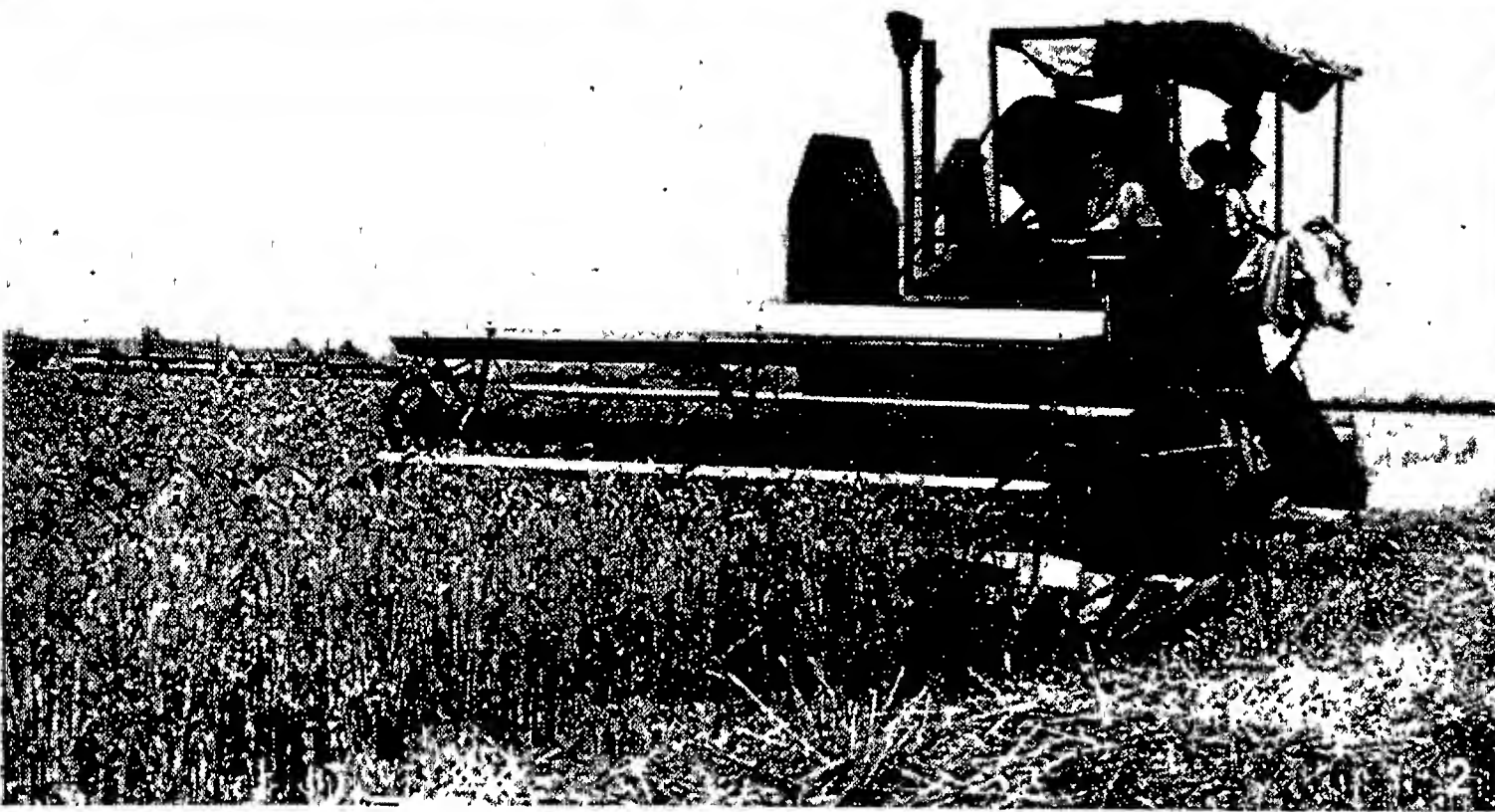
FARM: MODERN FARM BUILDINGS AND MECHANICAL CULTIVATORS



1. Motor-driven garden cultivator. 2. Potato lifting machine, with endless chain drive and conveyor belt. 3. Battery of seed drills attached to a tractor. 4. Power-driven harrow, showing the zig-zag action of the tines. 5. Drainer (tractor-attached) cutting a trench. 6. Tractor-mounted mowing machine, with power-operated cutter bar. 7. Combined tractor and plough, the blades lifted by finger-tip control. 8. Sack lorry-loader powered by small petrol engine

FARM: POWER-DRIVEN IMPLEMENTS TO AID THE FARMER

Photos 1 and 5, Farmer and Stockbreeder

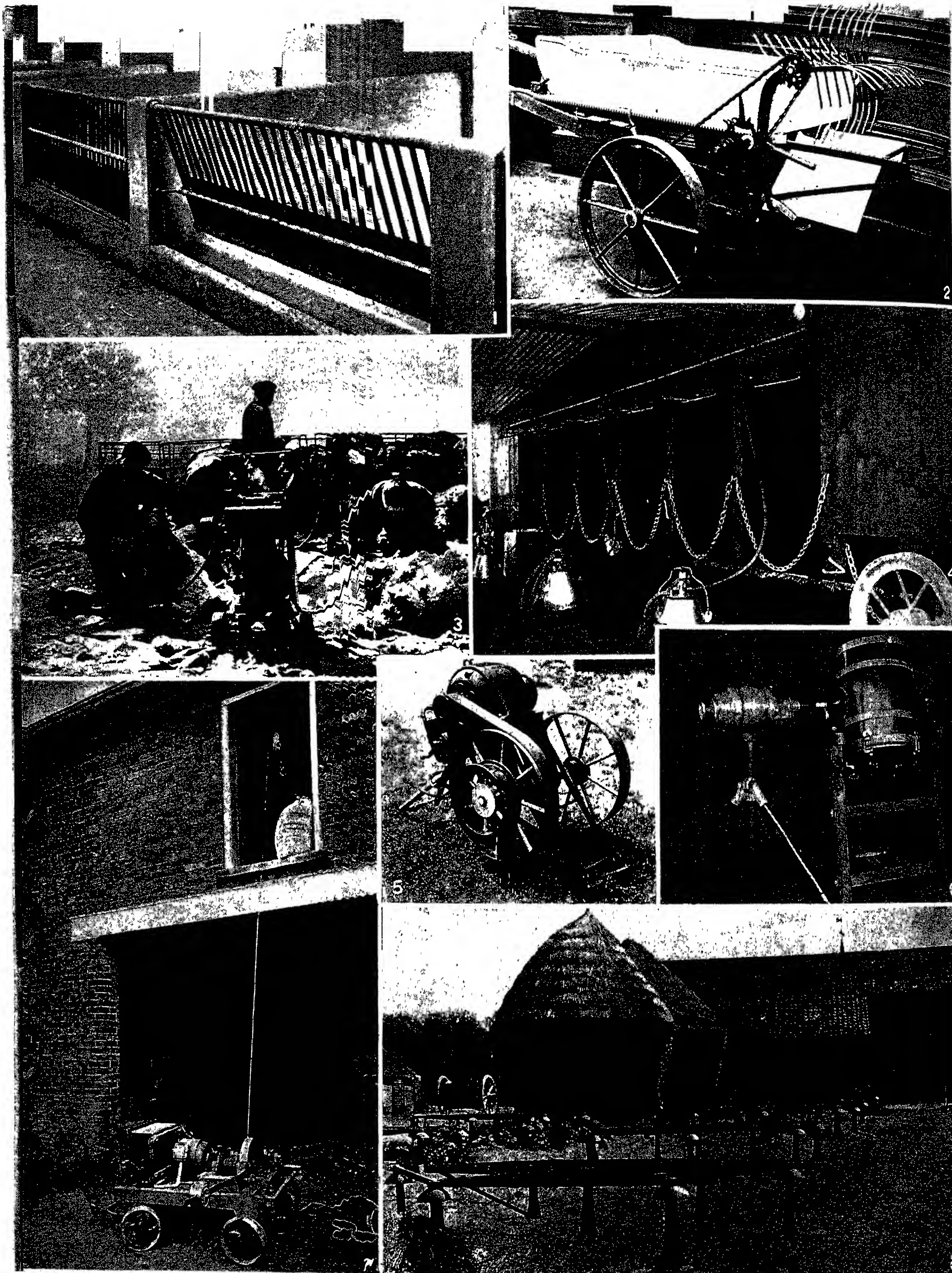


1. Combine machine, threshing corn, and trussing and delivering straw to a stack, in one operation. 2. Self-propelled combine harvester, cutting and threshing grain. 3. Loading lucerne on to light two-wheeled trailer drawn by tractor.

4. Hay tedder at work, gathering and spacing the hay ready for loading. 5. Stacking straw into a Dutch barn with a petrol-driven elevator. 6. Hammer mill in which a series of small revolving hammers takes the place of rollers

FARM: SPEEDY AND EFFICIENT METHODS OF FIELD HARVESTING

Photo 3, Farmer and Stockbreeder



1. Pig pens, with swing panel giving ease of access to feeding trough. 2. Manure spreading machine. 3. Power-driven clippers for sheep shearing. 4. Field milking bail, with mechanical milking and recorder attachment. 5. Multi-

purpose electric motor drive. 6. Portable electric motor operating a milk churn. 7. Mobile electric motor used for barn loading. 8. Iron rick stands which raise the base of a stack three feet clear of the ground

FARM: FITTINGS AND MACHINERY OF THE FARMYARD

Photos 2 and 7, Farmer and Stockbreeder

rotation with farm crops (*see* Rotation of Crops).

Specialist farms concentrate in the main on one crop or stock; many of them are associated with pig and poultry rearing. Hill sheep farms are typical of the mountainous districts of Scotland, Wales, and the N. of England.

Ranches, estancias, and cattle and sheep stations are found in the open, uncultivated spaces of N. and S. America and of Australia.

The farm has tended to retain its identity as a unit over long periods, and the farm buildings of the past have often been of very solid construction, unsuitable for adaptation to changing technical developments. New buildings are, however, frequently constructed on simple lines which make rapid adaptation to new requirements easy. Developments in transport, and in the use of machinery to do work previously done by human labour, have also influenced the construction of farm buildings.

The transmission of electricity to the farm has probably effected the most revolutionary change in its economy. While in Denmark very few, even of the smallest holdings, are without main electricity, in England and Wales of the 290,600 farm units covered by the national farm survey of 1941-43, only 77,400 were connected to a public supply, more than half for light alone; 8,700 had a private supply. The cost of installation and upkeep of wiring to carry a comparatively small load, rather than lack of appreciation of the value of electricity to the farmer, hinders its wider application in Great Britain. Electricity probably has most to offer to the dairy farmer in the form of power for milking machines, cooling plant, washing and sterilising of apparatus but it has many uses in general and poultry farms, as well as in horticulture, for *e.g.*, crop drying, grain sprouting, electro-silage, electroculture, bee hive heating, ultra-violet irradiation, electric fences, temperature control in storage places.

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Farman, HENRY (b. 1874). French aviator and aircraft designer. Son of an English journalist, he was born in Paris May 26, 1874. He became a racing cyclist and later founded a factory for the production of cycles and motor cars. He took up aero-

nautics in 1907 and flew the first Farman aircraft, a biplane, at Issy-les-Moulineaux. In 1908 he established a flying school and aircraft works at Buc, near Versailles, and a year later at Reims became the first pilot to fly a circuit of 100 miles.

In 1910 Henry Farman's brother Maurice founded an aircraft factory, and in 1912 the two combined their resources to erect a new factory at Billancourt. They specialised in the construction of military biplanes and supplied large numbers to the British and French governments, notably the Maurice Farman "Longhorn" and "Shorthorn." The Farmans originated the pusher type of air-screw, and spent several years developing a stratosphere aeroplane with pressurised cabin.

Farmer. One who farms land, an agriculturist. Originally the word had a different meaning, referring to one who collected the taxes by contract. The farmer collected as much as he could, but paid over a fixed sum, called the *firma*, to the king. There was a system of this kind in Rome; it was followed by the sheriffs in medieval England. The word was used later for one who took over a piece of land, paying a fixed sum for the right to cultivate it. *See* Agriculture; Farm.

Farmer, JOHN (1835-1901). A British musician. Born at Nottingham, Aug. 16, 1835, he studied music at Leipzig and Coburg, and afterwards taught it at Zürich. In 1862 he settled at Harrow, and in 1864 was made music master. From 1885 until his death on July 17, 1901, he was organist of Balliol College, Oxford, where he arranged Sunday even-



John Farmer,
British musician
Elliot & Fry

organist of Balliol College, Oxford, where he arranged Sunday evening concerts and founded the Musical Society. He wrote songs (including the famous Gaudeamus) and oratorios and edited volumes of songs for soldiers and sailors, and for children.

Farmer, SIR JOHN BRETLAND (1865-1944). British botanist. Born at Ather-

stone, April 5, 1865, and educated at Magdalen College, Oxford, he was demonstrator in botany to the university, 1887. In 1892 he became assistant professor of biology at the imperial college of science, S. Kensington. In 1895 his chair was made independent. During 1907-29 he was professor of botany and director of the biological laboratories there. He organized the Forest Products Research Board; and he helped to found a college of tropical agriculture in Trinidad. Knighted in 1926, an F.R.S. and royal medalist, Farmer died Jan. 26, 1944.

Farmer-General. Member of a financial organization in France under the monarchy, who, in consideration of payment of an agreed sum to the government, secured the privilege of collecting taxes. The system, based upon that of the Roman publicans (*q.v.*), seems to have been in existence in France in the 14th century and was firmly established in the 16th. Following the Revolution the farmers-general were abolished.

Farmers' Club. London club founded in 1842, for those interested in agriculture. It is housed at 2, Whitehall Court, S.W. The term is also often applied to the co-operative trading societies formed under the auspices of the Agricultural Organization Societies of England, Scotland, and Ireland. *See* Agriculture.

Farmer's Wife, THE. Comedy of Devon country life by Eden Phillpotts. Produced at the Court Theatre, London, March 11, 1924, it ran for 1,329 performances, and made the reputation of Sir Cedric Hardwicke, who appeared as Churdles Ash. It was revived in 1928 and 1932.

Farnborough. Urban dist. and parish of Hampshire, England. It is 33 m. S.W. of London, and is served by rly. A mausoleum attached to S. Michael's Abbey church, built by the Empress Eugénie, contains the remains of Napoleon III, the Prince Imperial, and the empress herself, who for many years lived at Farnborough Hill.

Farnborough is the site of the royal aircraft establishment controlled by the ministry of Supply (which was founded as the Royal Aircraft Factory



Farnborough. Mausoleum in which Napoleon III, the Empress Eugénie, and the Prince Imperial are buried

in 1912), the largest British centre for aeronautical research. The establishment has many wind tunnels for aeronautical investigation over a large range of speeds, in addition to extensive scientific laboratories, workshops, and a long runway for experimental flying. The Queen Bee (*q.v.*) pilotless target aircraft was among many inventions developed here. Pop. of Farnborough urb. dist. (1951) 26,291.

Another Farnborough is a village in Kent, 4 m. S.E. of Bromley.

Farnborough, THOMAS ERSKINE MAY, BARON (1815-86). British historian. Born in London



T. Erskine May,
Baron Farnborough

on Feb. 8, 1815, he was educated at the Bedford grammar school. In 1831 he became an assistant in the library of the house of commons, and in 1838 was called

to the bar. In 1846 he was made an examiner of private bills; in 1847 a taxing master; and in 1856 a clerk assistant to the house. In 1871 he was appointed clerk of the house of commons, and he retired in April, 1886, dying in London on May 17. He had been made a peer a few days before his death, but left no heir. Erskine May's long association with the house of commons, together with his aptitude for research, made him the chief authority on its procedure. He wrote a Treatise on the Law, Privileges, Proceedings, and Usage of Parliament, 1844; and devoted himself to the constitutional history of England, and his work dealing with the period 1760-1860, published 1861-63, remains the standard authority.

Farne, FEARNE, OR FERN ISLANDS, OR THE STAPLES. Group of seventeen rocky islets and rocks off the coast of Northumberland, England, separated from the mainland by the Fairway Channel. Farne or House, the largest (16 acres), was the retreat of S. Cuthbert (*q.v.*) in the 7th century, and Longstone with its lighthouse is famous for its association with Grace Darling (*q.v.*).

Farnell, LEWIS RICHARD (1856-1934). English scholar. He was born at Salisbury Jan. 19, 1856. As fellow of

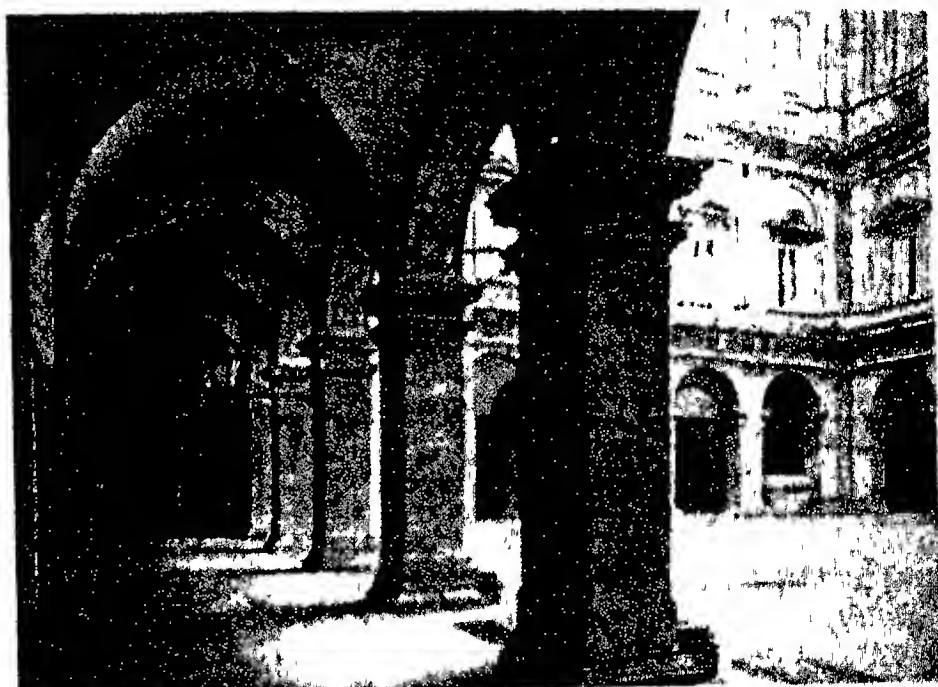
Exeter College, Oxford, he studied classical architecture in Germany, Greece, and Asia Minor. He was rector of his college 1913-28 and vice-chancellor of the university 1920-23. He died March 29, 1934. The leading authority of his day on Greek religion, Farnell published *The Cults of the Greek States*, 1896-1909; *Hero-Cult*, 1921; *Outline of the History of Greek Religion*, 1921; and his reminiscences, *An Oxonian Looks Back*, appeared posthumously.

Farnese. Name of the Italian ducal family of Parma during the 16th and 17th centuries. First appearing in history as lords of Farnete, in Tuscany, in the 12th century, they became prominent by the election as pope Paul III of Alessandro Farnese, 1534, brother of Giulia, favourite of pope Alexander VI. In 1545 Paul gave the duchy of Parma to his natural son Pierluigi (1503-47), a notorious libertine, murdered by partisans of Charles V at Piacenza. Of Pierluigi's sons, Alessandro (1520-89) became a cardinal in 1534, and completed the Farnese Palace (*v.i.*) in Rome, while Ottavio (1521-86), after a long struggle with his grandfather the pope, became 2nd duke of Parma in 1551, recovering Piacenza a few years later. His son Alessandro was the famous soldier in Spanish service, better known as the 3rd duke of Parma (*q.v.*).

Elizabeth Farnese (1692-1766) was the last notable member of the family. The daughter of Odoardo Farnese, she married in 1714 Philip V of Spain, whose weakness, and later insanity, left her the

virtual ruler of Spain during his nominal reign. With Cardinal Alberoni she worked for the restoration of Spanish rule in the lost Italian provinces, a scheme broken only by the demands of the Quadruple Alliance in Jan., 1720. The Farnese succession ended with Antonio (1679-1731). Consult Elizabeth Farnese, E. Armstrong, 1892.

Farnese Palace. Building in Rome, one of the finest examples of later Renaissance architecture. It was designed and begun in 1530 by Antonio da Sangallo, and the work was carried on and completed by Michelangelo, Vignola, and Giacomo della Porta. The length of the front façade is 190 ft., and the building is 260 ft. deep and 97 ft. high to the top of the cornice. The latter, the most striking feature, was added by Michelangelo, who was also responsible for the upper



Farnese Palace, Rome. Arcade of the courtyard, a magnificent example of the architectural work of Michelangelo

storey which it crowns. The courtyard on the S. side is surrounded by arcades, modelled on those of the Colosseum. The building was commissioned by Cardinal Alessandro Farnese, later Pope Paul III, and belonged to the Farnese family until the 18th century, when it passed to the king of Naples.

Farnham. Market town and urban district of Surrey, England. It stands on the northern arm of the river Wey, 38 miles S.W. of London, and has a railway station. At one time a centre of the wheat and hop trade, it has become primarily a residential area. It has some good Georgian architecture. S. Andrew's, the parish church, is a fine example of Transitional architecture; at Vernon House Charles I slept on his way to London for execution; and there are 16th-century almshouses.

Above the town stands the castle, residence of the bishop of Guild-



Farne. S. Cuthbert's church, Inner Farne, on the site of the hermitage where the saint died in 687
Valentine

ford. The first castle was built in the 12th century, but this and also its successor were destroyed. The present building dates mainly from the 17th century. Near the town are Moor Park, the residence of Sir W. Temple, where for a time Swift lived, and the ruins of Waverley Abbey, the earliest English Cistercian house. Farnham belonged to the bishop of Winchester before 1066, and one of the bishops made it a chartered town. A bor. until 1789, it gives its name to a co. constituency. Here Cobbett was born, his birthplace being now an inn, The Jolly Farmer. Caesar's Camp, 2 m. N., dates from the Iron Age. Market day, Mon. Pop. (1951) 23,911. Other places called Farnham are in Bucks, Dorset, and Suffolk.

Farnham. Town of Quebec, Canada. It is on Yamaska river, in Missisquoi co., 40 m. E.S.E. of Montreal, and is served by C.N.R. and C.P.R. With a government experimental tobacco farm, it is the centre of a tobacco growing region, and has sawmills and butter and cheese factories. Pop. (1951) 4,926.

Farnol, (JOHN) JEFFREY (1878-1952). British novelist. Born Feb. 10, 1878, educated at a private school, he began writing while in his teens. In 1902 he went to America, where he painted theatrical scenery, and published his first volume, *My Lady Caprice*, 1907 (later reissued as *Chronicles of the Imp*). In 1910 he returned to England, and with *The Broad Highway* achieved popularity as a writer of romance, with a special interest in pugilism. Later stories included *The Amateur Gentleman*, 1913; *Beltane the Smith*, 1915; *Black Bartlemy's Treasure*, 1920; *The Quest of Youth*, 1927; *The Jade of Destiny*, 1931; *The Way Beyond*, 1933; *Murder by Nail*, 1942. He died Aug. 9, 1952.

Farnworth. Borough of Lancashire, England, 3 m. S.E. of Bolton. It is served by railway. Sharing in the industries of Bolton, it has spinning mills, engineering works, and machinery shops, while around are coalmines. S. John's is the parish church. The council owns libraries, markets, baths, cemetery, and parks and recreation grounds. Water is supplied from Bolton. Farnworth gives its name to a county constituency. It was chartered as a borough in 1939. Market days, Mon., Fri., and Sat. Pop. (1951) 28,616.

Faro. Gambling card game. It is one of the oldest of banking games, supposed to be of Italian origin,

and under the name of Pharaoh was very popular in the time of Louis XIV. It requires costly apparatus and a lay-out. A full pack of 52 cards is put into a dealing box with an open top, one card being released at a time. The first card in sight at the beginning of each deal is called *soda* and the last card left in the box is *in hoc*. The dealer or banker withdraws *soda* and places it some little distance away; the next card, termed *the loser*, he lays by the side of the box. The third card taken out is *the winner*, which he places on the *soda*; thus, each alternate card is a winner or loser, eventually forming two separate piles, with *soda* and *loser* for foundation. The object of the players is to forecast correctly (indicated by the way in which they stake their money upon the lay-out) which particular card of any suit will win or lose.

Faro. Administrative dist. of S. Portugal, coextensive with the prov. of Algarve. The climate is genial and the soil fertile, producing olives, dates, almonds, figs, and cereals. Area 1,937 sq. m. Pop. (1950) 325,971.

Faro. Seaport and city of Portugal, capital of Algarve prov., and an episcopal see. It stands on the Atlantic, at the mouth of the Rio Feroso, 20 m. S.W. of Tavira, and is the terminus of the Lisbon-Faro rly. Its harbour is large and sheltered, but shallow and tidal. The town possesses a cathedral, a military hospital, a museum, and a ruined Moorish castle. Its large public square is the centre of the life of the city. It exports fruit, vegetables, wine, cork, sumach, sardines, anchovies, tunny, and baskets. Faro was taken from the Moors by Alphonso III of Portugal, burned by the English in 1596, and almost destroyed by an earthquake in 1755. Pop. 19,695.

Faroe Islands (Dan. *Färøerne*, sheep island). Group of islands in the N. Atlantic, belonging to Denmark. The group lies about 195 m. N.W. of the Shetlands, and 250 m. S.E. of Iceland. There are 21

islands, 17 of them inhabited. Of volcanic and basaltic formation, they are mountainous, rising in Slatarretinde in the island of Osterö to 2,890 ft., with lofty and steep cliffs and deep fjords, and separated from each other by swift and dangerous currents. The rainfall is heavy, and storms are frequent. Lying between lat. 61° 20' and 62° 20' N., not a great distance from the Arctic Circle, the islands are mild but moist, and the harbours are seldom frozen. There are no trees, and barley is the only cereal grown: turnips and potatoes thrive, coal and peat are found.

The chief industries are sheep raising, cattle breeding, wild-fowling, whaling, and fishing. Sheep, fish (wet and dried), wool, feathers, skins, tallow, butter, and fish-oil are exported. The largest island is Strömö, with the capital, Thorshavn; Suderö is the next largest. There are cathedral ruins in Kirkjö on Strömö. Colonised by the Norwegians in the 9th century, the Faroes became Danish in 1380. The people still speak an old Norse dialect. They have a local parliament which in 1948 was granted complete autonomy by Denmark. In religion the Faroese are mostly Lutheran. The chief magistrates of the islands are an amtman, who is also a military commandant, and a land-vogt, who is the chief of the police.

After the German invasion of Denmark in 1940, the Faroes were occupied by Great Britain to prevent their becoming a base for enemy operations against Allied shipping. A force of Royal Marines landed at Thorshavn without opposition on April 13, 1940. A radio station and aerodrome were laid out there, and R.A.F. flying-boats operating from the Faroes did invaluable work escorting convoys and hunting submarines. The British bases on the islands helped to prevent blockade running to the Norwegian coast. The islands retained their own internal administration, and at the end of the war the British garrison was withdrawn. Area 540 sq. m. Pop. 25,744



Faroe Is. Klaksvig, the principal town on Bórdo Island, and Klaksvig Mountain

Farouk I (b. 1920). King of Egypt. Son of Fuad I and Queen Nazli, he was born in Cairo,



Farouk I,
King of Egypt

Feb. 11, 1920, and spent his childhood in Naples and Rome. Created Emir es Said, or prince of Upper Egypt, in 1933, he lived in England 1935-36, when he studied for the R.M.A., Woolwich. Recalled to Egypt on the death of his father, in 1936, he was invested as king July 29, 1937. Until then the royal powers were exercised by a council of three regents. Farouk married (1) Farida Zulfikar, 1938 (divorcing her 1948); they had three daughters; (2) Narriman Sadek, 1951, to whom a son was born in Jan., 1952. Six months later Farouk was forced by a military coup to abdicate in favour of his son. For the events of his reign, see Egypt, Modern History.

Farquhar, GEORGE (1678-1707). Irish dramatist. Born in Londonderry and educated at Trinity College, Dublin, he started life as an actor in Dublin, but obtained a commission in the army, 1702. His first play was *Love and a Bottle*, 1699, which was followed by *The Constant Couple*, 1700; and *Sir Harry Wildair*, 1701. His most notable production was *The Beaux' Stratagem*, 1707, two characters in which, Lady Bountiful and Boniface, the innkeeper, have passed into the language as types. The *Recruiting Officer*, 1706, contains the song *Over the Hills and Far Away*. Farquhar died in pecuniary difficulties. He had sold his commission to marry a professed heiress, who turned out penniless. Farquhar magnanimously forgave her. His large-heartedness is reflected in his comedies which, not perhaps so witty as those of Congreve, are pervaded by a sympathy that gives reality to plot and characters. His complete works, ed. C. Stonehill, were issued 1930.

Farr, THOMAS GEORGE (b. 1914). Welsh boxer. A native of Tonypandy, Glam., he worked as a youth in the coal mines, but sought

a new career as a professional boxer. From the humblest beginnings, he became British heavyweight champion on March 15, 1937, defeating Ben Foord, and in Aug. went the full 15 rounds with Joe Louis, world champion, losing only on points. "Tommy" Farr was the first Briton to fight for the world heavyweight title since 1911. He relinquished the British title early in 1938.

Farragut, DAVID (GLASGOW) (1801-70). American sailor. Born at Knoxville, Tenn., July 5, 1801, of Spanish descent, he entered the navy, and in 1825 was promoted lieutenant. When the Civil War came in 1861, notwithstanding his southern birth, he offered his services to the Washington government, and in 1862 was given command of the Western Gulf blockading squadron. His great popularity was intensified by his brilliant forcing of the passage of the Mississippi and capture of New Orleans. After an unsuccessful operation against Vicksburg, with the aid of monitors he defeated Buchanan at Mobile in 1864, but his health being undermined by the climate he returned to New York the same year, being made the first rear-admiral of the U.S. navy. In 1866 he was promoted admiral, and retired 1867. He died at Portsmouth, New Hampshire, Aug. 14, 1870.

Farrant, RICHARD (c. 1530-80). British organist and composer. A gentleman of the Chapel Royal, Farrant was for some time organist of St. George's Chapel, Windsor. Much of the music attributed to him has been proved to be by other composers, but it is probable that he composed the beautiful anthems, *Call to Remembrance*, and *Hide Not Thou Thy Face*. He died Nov. 30, 1580.

Farrar, FREDERIO WILLIAM (1831-1903). British divine and writer. Born at Bombay, Aug. 7, 1831, he was educated at London



Elliot & Fry

University and Trinity College, Cambridge, and became in 1855 an assistant master at Harrow. He was headmaster of Marlborough College from 1871 to 1876, when he became canon of Westminster and rector of S. Margaret's, being appointed archdeacon of Westminster in 1883. Farrar

was made dean of Canterbury in 1895. His *Life of Christ*, 1874; *Life of St. Paul*, 1879; and *Lives of the Fathers*, 1889, were successful; but he is also remembered for his school stories, including *Eric, or Little by Little* (q.v.), 1858. Dean Farrar died March 22, 1903.

Farren, ELIZABETH (c. 1759-1829). British actress. The daughter of a Cork surgeon turned actor,



Elizabeth Farren,
British actress

After Sir T. Lawrence

she made her first London appearance at The Haymarket, June 9, 1777, as Kate Hardecastle. She made her début at Drury Lane, Sept. 8, 1788, as Charlotte Rusport in *The West Indian*, and acted at this theatre and The Haymarket till her retirement in 1797. At Drury Lane she succeeded Frances Abington as impersonator of fine ladies, e.g., Lydia Languish, Millamant, Lady Teazle, and Angelica in Congreve's *Love for Love*. In 1797 she married the 12th earl of Derby. She died April 23, 1829.

Farren, ELLEN OR NELLIE (1848-1904). A British actress. A granddaughter of William Farren (v.l.),

and born at Liverpool, April 16, 1848, she played in comedy, farce, and burlesque at Sadler's Wells, The Olympic, and Queen's. She joined John Hollingshead's company in 1868 at the (old) Gaiety Theatre, where she remained under his management, and that of George Edwardes, till her retirement in 1891. She was unrivalled as principal boy. She died April 28, 1904.

Farren, WILLIAM (1786-1861). British actor. He made his début on the London stage, Sept. 10,



William Farren,
British actor
From a daguerreotype
by Mayall



Nellie Farren,
British actress
Downey

1818, as Sir Peter Teazle at Covent Garden, where he remained till 1828. He played Sir Peter at Drury Lane, Oct. 16, 1828, remaining a member of the "company" till 1837.

He returned to Covent Garden, which he left a few years later to join Benjamin Webster as stage-manager at The Haymarket, where he stopped ten years. Subsequently he managed The Strand and The Olympic, taking leave of the public at The Haymarket, July 10, 1855, in his favourite part of Lord Ogleby in *The Clandestine Marriage*. As the old man of 18th-century comedy he was unrivalled. He died Sept. 24, 1861.

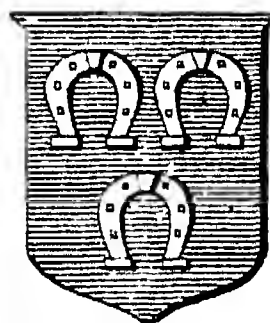
Farrer, THOMAS HENRY FARRER, 1ST BARON (1819-99). British economist. The son of a London solicitor, he was born June 24, 1819. Educated at Eton and Balliol College, Oxford, he became a barrister, but his career was influenced by his close friendship with Sir Stafford Northcote, who secured for him in 1848 a position in the board of trade. During 1865-88 he was permanent secretary to the board. He was instrumental in securing legislation concerning merchant shipping and bankruptcy. In 1883 he was made a baronet, in 1893 a baron. As an economist Farrer made his reputation after his retirement. He was a strong free trader and a critic of high national expenditure and bimetallism. He died Oct. 12, 1899. Of his writings the best known is *Studies in Currency*, 1898.



Farrer

Farrier. Name given originally to a man who shod horses, the word being derived from the Latin *ferrum*, iron. After a time the farrier began to attend to the diseases of the horses, and farriery was the name for what is now more generally known as veterinary surgery (*q.v.*).

Farriers' Company, THE. London city livery company. Dating from 1356 as a fraternity, it was granted a charter in 1674. Farriers, who were also called ferrers, ferriers, and ferrones, are mentioned in the 13th century. They owe their ordinances to a complaint that certain unskilled



Farriers' Company arms

ferrones, having set up forges in the city, had caused damage to or loss of many horses. In 1758 an act of common council confirmed on all operative farriers the obliga-

tion of taking up the freedom of the company. While this rule has been abandoned the company has long taken an active interest in the welfare of the craft by the offer of prizes for good workmanship, etc., and in 1890, in cooperation with the Royal Agricultural Society and the Royal College of Veterinary Surgeons, promoted a scheme for the national examination and registration of farriers or shoeing-smiths. The archives of the company were almost entirely destroyed by fire in 1666. Its offices are at 80, Bishopsgate, E.C.

Farringdon Street. London thoroughfare running S. from Charterhouse Street to Ludgate Circus, E.C. Named after the city ward in which it is situated, it was built over the Fleet Ditch, now a sewer, in 1826-30. Fleet Market, which once occupied the site, was opened Sept. 30, 1737, and for 92 years remained a centre for the sale of meat, fish, and vegetables. It was removed in 1829-30. The market for fruit and vegetables built between Farringdon Street and Shoe Lane, N. of Stonecutter Street, and known as Farringdon Market, was opened Nov. 20, 1829, but the site, which covered 1½ acres, was sold in 1892 and later covered by a fine block of buildings.

Farringdon Street is spanned by Holborn Viaduct, and contains the Memorial Hall (*q.v.*), built to commemorate the fidelity to conscience of 2,000 ministers ejected from the church in 1662 by the Act of Conformity; The Fleetway House, headquarters of the Amalgamated Press; and is fronted on the E. side by part of the London Central (Smithfield) Markets. Fleet Prison stood on ground partly occupied by the Memorial Hall.

N. of Charterhouse Street is Farringdon Road, notable for its open market and bookstalls, with a Metropolitan railway station (Farringdon).

Farringdon Road was originally called Victoria Road. It extends to King's Cross Road, and was made in 1856. Street and road were heavily damaged by German bombs in the Second Great War, over 100 lives being

lost when a rocket bomb fell, March 8, 1945. See Fleet Prison.

Farrow's Bank. Former British bank. Founded in 1904 by Thomas Farrow (1862-1934), it was registered as a credit bank under the Industrial and Provident Societies Act. In 1907 it was registered as a joint stock company. With a capital of £1,000,000, the bank had 75 branches, mainly in England. The bank closed its doors in Dec., 1920, with great loss to small depositors, and in 1921 Farrow and another official were sentenced to imprisonment for fraud in that connexion.

Farrukhabad. See Farukhabad.

Fars OR FARSISTAN. District of Persia, formerly a province. It lies on the eastern shore of the Persian Gulf. From the warm coastal plain the country rises into the mts., where the climate is cold. The highest mt. is the Kuh-i-Bul, 13,000 ft. The rivers are small and not numerous. There are several lakes, the principal being Niris. The chief town is Shiraz, the chief port Bushire. The district con-



Farringdon Street. View looking north towards Holborn Viaduct; on right, marked by clock, is The Fleetway House

tains the ruins of Persepolis, ancient capital of the Persian empire. Many parts of the province are fertile, and produce wheat, barley, rice, cotton, fruits in profusion, and an excellent tobacco.

Farsetia. Genus of annual and perennial herbs and sub-shrubs of the family Cruciferae. Natives of S. Europe, Asia, and Africa, they have opposite, undivided leaves, and white or yellow flowers.

Farson, NEGLEY (b. 1890). American journalist. Born at Plainsfield, N.J., May 14, 1890, he went to Pennsylvania university and became a civil engineer. After the First Great War he represented the Chicago Daily

News as special correspondent in India and Egypt, and later in Europe, spending five years in London. He resigned in 1935. His two books of autobiography, *The Way of a Transgressor*, 1935, and *A Mirror for Narcissus*, 1956, attracted wide attention. His other books include *Bomber's Moon*, 1941; *Going Fishing*, 1942; and *Caucasian Journey*, 1951.

Farthing (A.S. *feorþa*, fourth). Name of the smallest British bronze coin, value one quarter of



Farthing. Obverse and reverse of a 1949 George VI farthing

a penny. From its first appearance under Edward I, until about 1555, it was a silver coin. A copper farthing was coined in 1613, but did not form part of the true coinage till a reissue in 1672, under Charles II, who also struck a tin farthing, with a circle of copper inset, in 1684. Copper half-farthings circulated between 1842-69. The farthing became a bronze coin in 1860, and has a standard weight of 43.750 grains. The coin is legal tender up to the number of four at one time. The wren design introduced on the reverse of the coin in 1937 is said to symbolise the least of the British coins by the smallest of British birds.

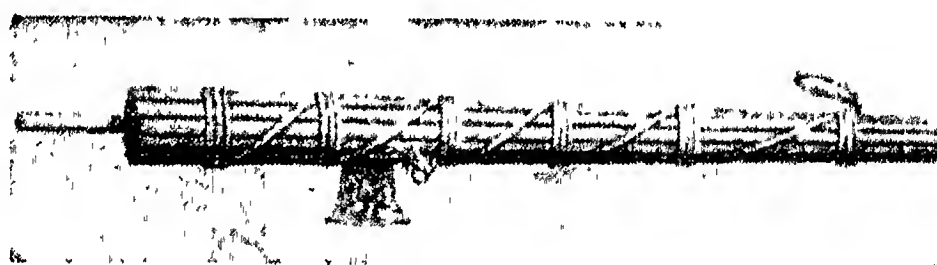
Farthingale (Span. *verdugado*, hooped). Hooped framework supporting and extending a wide skirt. The fashion was introduced from Spain into England in the time of Elizabeth I, and continued until about the middle of the 17th century. It grew to a prodigious size, the big hoop at the level of the hips giving a flat, circular surface, and keeping the skirt well away from the figure. The farthingale, as it was then called, was revived in rather a different form in the time of Queen Anne, when the skirt became more bell-shaped. It was abolished by royal command in George IV's reign.

Farukhabad. District and town of India. In the N. of the Allahabad division of the Uttar Union, the district has an area of 1,642 sq. m. The town, founded early in the 18th century, lies near the Ganges, and is an important railway junction. Part of the town was formerly a cantonment. With

Fatehgarh, 3 m. S.E., the headquarters of the district, it forms a single municipality. Calico printing is the chief industry; brass utensils are made. It is also a trade centre. Chief crops of the dist. are wheat, barley, millet, gram; the poppy, cotton, sugar-cane, and tobacco are also grown. Pop. (1951) town, 74,205; dist., 1,092,641.

Farwell, Sir George (1845-1915). English judge. Born at Codsall, Staffs, Dec. 22, 1845, he was educated at Rugby and Balliol college, Oxford, and called to the bar in 1871. Judge of the high court from 1899, he gave judgement in the famous *Taff Vale* (q.v.) case, in 1901. Reversed by the court of appeal, his judgement was upheld by the house of lords, and led directly to the passing of the Trade Disputes Act in 1906. Farwell was a lord of appeal 1906-13. He died Dec. 30, 1915.

Fasano. Town of Italy, in the prov. of Brindisi. It is 35 m. by rly. N.W. of that port. The old palace of the Knights of S. John is now the town hall. In the vicinity are the ruins of Egnatia, an ancient port on a branch of the Appian Way. Situated in an olive-growing district, Fasano has many oil mills. Pop. (1951) 25,302.



Fasces. Roman symbol of magisterial authority

Fasces (Lat. bundles). Bundles of rods with an axe bound up in the centre. Such a bundle was the emblem of authority in ancient Rome, although it originated with the Etruscans. Fasces were carried before the consuls by lictors. The consul was preceded by twelve lictors bearing fasces, and the head of the state by 24; praetors of towns, of provinces, and of the army, had fewer. Under the empire the consuls, who then ranked merely as civil magistrates, had eight fasces. Fasces have been used as their emblem by various Italian political associations, and were adopted by Mussolini in 1919 as the badge of his party. See Fascism.

Fascia. In anatomy, layer of connective tissue interposed between the skin and the muscles, and prolonged inwards between the muscles so as to form sheaths around them. The strength and

thickness of fascia vary in different parts of the body. On the outer side of the thigh, e.g., it forms a dense, strong structure, the *iliotibial band*, which helps to steady the body in the erect position.

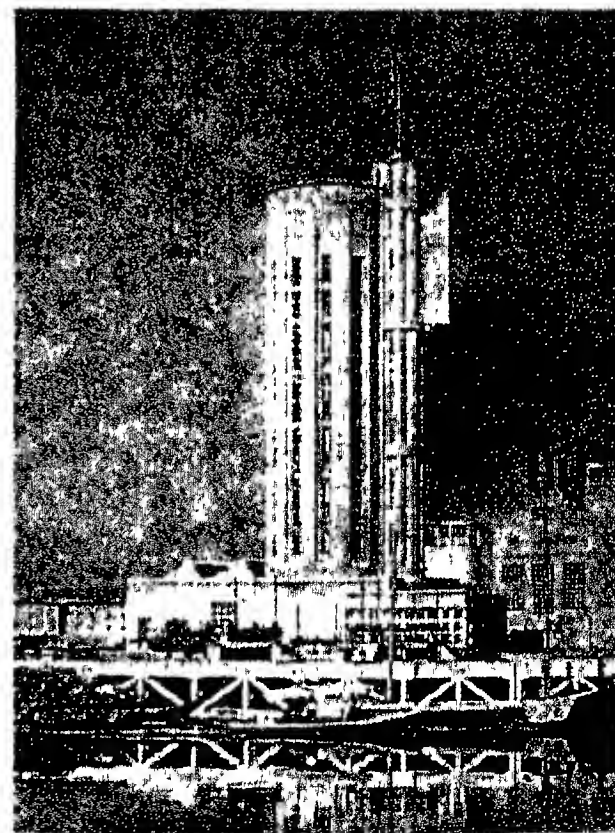
Fascia or **FACIA** (Lat. bandage, fillet). Architectural term applied originally to the bands or divisions of an Ionic entablature (q.v.), now extended to include any flat band or facing in an entablature. The strip of boarding over a shop front, bearing the name of the firm, is known as a fascia board.

Fasciation. Abnormal growth of stems when they become flattened, and the branches, instead of being separate, coalesce with the stem. This is the constant condition of the flowering parts of *Celosia cristata* (cock's comb q.v.); but is often found in other herbs and trees. The willow family and the ash often exhibit the abnormality in their upper branches.

Fascine (Lat. *fascina*, faggot). Cylindrical bundle of brushwood 6 to 18 ft. long and 6 to 9 ins. in diameter used in revetments of military earthworks. A fascine is built up on trestles and compressed by means of a choker or chains, and then bound at intervals with withies of flexible wood. When made of long, heavy boughs, a fascine is called a saucisson. Fas-

cines are also used in making sea and river walls to protect foreshores subject to washing, or to collect sand and silt to raise the bottom of water-covered

land to form an island, as a break-water against inroads or for land reclamation, as in the Netherlands.



Fasces. Mussolini's party badge applied to architecture: a factory at Torre di Zuino, Italy

FASCISM: A POLITICAL THEORY

G. M. Franzero, Journalist and Writer on Italian Affairs

The rise, doctrines, and history of the party which, embodied in Mussolini, ruled and ruined Italy between 1922 and 1943. See also Italy; Mussolini; Nazism

Fascism was the name given to the political theory of the Italian party founded by Benito Mussolini in March, 1919, in Milan. It became, after the seizure by Mussolini of power in Oct., 1922, a synonym for the regime that governed Italy until July 25, 1943. The name, taken from the *fascēs* (r.s.), was chosen to symbolise the close union of its adherents: its emblem was the fascēs of the lictors on a tricoloured shield.

Fascism, as a doctrine and as a political conception, stood in direct antithesis to socialism and liberalism. Whereas the philosophy of both socialism and liberalism is based upon the importance of man as an individual, and national life is the sum of the aggregate of individuals in each country, according to fascism the state was paramount, and the individual of value only in so far as he subjected his interests to those of the state. No individual or group outside the state—political parties, cultural associations, economic unions, social classes was allowed. Fascism did not recognize the class-struggle likewise, and was opposed to trade unionism.

Fascist Scorn for Peace

Fascism did not believe in the feasibility or utility of perpetual peace—a tenet which was the actuating principle of Italian foreign policy from 1922 until 1940. It discarded pacifism as implying supine renunciation, and proclaimed war as the apex of all human energies at their maximum tension. It despised all international structures such as the League of Nations—even if it accepted them as useful or expedient in the ordinary intercourse of international relations and politics. Instead, fascism exalted nationalism as the noblest human aspiration. Lastly, fascism rejected the economic interpretation of felicity as something to be secured socially at a given stage of economic evolution; though it found no better substitute for this than its somewhat cumbersome and obscure conception of the corporate state. From such a philosophy there could only follow, in the actual application of fascism as a form of rule, dictatorship described as the totalitarian state.

It is odd to recall that fascism was founded by Mussolini, who

had been a rabid socialist. One explanation might be that in 1919, when Italy after the First Great War found herself in the throes of spiritual and economic turmoil, socialism in that country, as a doctrine, was dead, and it existed in practice only as a grudge. In such conditions, it is understandable that fascism, with its conception of national will power as a manifestation of the country's vitality, should have appealed strongly to the politically untrained Italian masses.

Its Revolutionary Programme

The first programme of fascism (March, 1919) was decidedly revolutionary. It demanded a constituent assembly which was to be the Italian section of the International Constituent Assembly of the Peoples; the proclamation of an Italian republic; the sovereignty of the people and the extension of the vote to women; the abolition of the senate; the abolition of all titles of nobility; the abolition of compulsory military service; international disarmament; dissolution of limited liability companies; abolition of the banks; conscription and limitation of private capital; confiscation of unproductive capital; the land for the peasants; management of industry transport, and public services by unions of technicians and workers.

This programme, however, was soon abandoned, and replaced by propaganda likely to secure to the new party the financial backing of the industrialists and the support of the lower middle classes, which in Italy are the backbone of the country. At the elections of 1919 no fascist candidate was returned; but during 1920 the new ideas gained ground, and Italy saw the coming into existence throughout the country of *squadre* or bands of young men calling themselves *squadristi*, mostly ex-servicemen made desperate by the prevailing disorder, who took upon themselves what they considered the defence of the nation against the revolutionary tyranny of the "red" elements. At that time there was as yet no real fascist doctrine beyond this vague sense of outraged patriotism; but when at the end of 1922 the party seized power, fascism soon caught the people's imagination and secured

general collaboration by a programme that can be summed up as follows: the prestige of the state to be restored at all costs; the national finances to be placed on a sound basis; private property to be recognized in its social function; the state to control class conflicts; no strikes in public services to be tolerated; in foreign affairs, Italy to reaffirm and fulfil her mission as the bulwark of Latin civilization in the Mediterranean.

Only too soon it became clear that the fascist party meant to be one with the state, and that the regime was to all intents and purposes a dictatorship. But Mussolini enjoyed a vast degree of popularity; he knew the art of making people endure his iron fist; and he never let events, internal or external, deflect him from making the entire life of the nation subservient to his ambitions and imperialistic dreams. Fascism, as an imposition of a dictator's will upon the people, touched its peak in June, 1940, when fascist Italy entered the Second Great War on the side of Nazi Germany, only to suffer defeat in every field. Fascism ended when Mussolini was overthrown on July 25, 1943.

Interweaving State and Party

Twenty years of dictatorial rule were made possible only by interweaving in the closest manner the state and the party, till it was difficult to say where the line of demarcation, if any, existed. The hierarchy upon which the totalitarian fascist state rested was as follows: Mussolini was "chief of the government and Duce of fascism"; from him depended the government, the directorate of the party with its octopus-like machine reaching far and deep into the individual and collective life of the people; and next to Mussolini stood the fascist grand council which was in effect the supreme organ of the nation and had, in 1928, arrogated to itself the right of veto over the succession to the throne. Behind the party and regime was the fascist militia, described as voluntary although its members were handsomely paid and enjoyed exceptional privileges; it was nothing but the private army of the fascist party.

In the field of economics, fascism created the corporate state. The basic Act, 1926, of this new economic system regulated the legal and economic representation of employers and workers in all industries, trades, and professions, including agriculture. Associations for each trade or profession were

formed and called corporations. In 1927 the whole system received its special labour charter, the essential principle of which was that the activities of the corporations must never run counter to the interest of the state. The corporations were empowered to settle disputes over wages and labour, and to nominate members to sit on their many boards; eventually from the corporations were chosen the representatives who in 1937 composed the fascist chamber of corporations or the new kind of parliament of the fascist state, to take the place of the elective chamber of deputies, now discredited.

The labour charter of 1927 asserted the subordination of the individual citizen to national interests, and, although recognizing private initiative as the most effective instrument of production, it held the organizers of industry responsible to the state for results. Rapidly the whole system turned the entire economy of Italy into a machine working solely for the preparation of war. State finances, private capital, scientific research, technical direction, manual and intellectual labour—everything was made to converge towards the organizing of the corporate state for the ultimate end of war. The state and its interests were the supreme expression of the nation's life, with the dismaying result that when the fascist state collapsed, Italy crumbled into appalling chaos, political and economic.

The Movement outside Italy

The doctrine of fascism found many admirers, especially in its earlier period, when the iron rod of Mussolini's rule seemed to many foreign onlookers to work miracles in redressing the course of Italy's national life. Even in Great Britain a fascist movement sprang up, under the leadership of Sir Oswald Mosley, who in his varied career had been a conservative, a socialist, and an independent. His movement, modelled on German Nazism rather than Italian fascism, struggled on until it was banned in July, 1940. In several other countries the doctrine of fascism made its influence felt under different names and with various degrees of success, notably in Hungary, Rumania, Belgium, Spain, and Argentina. The most famous derivative from fascism was the National Socialist (Nazi) movement, founded by Adolf Hitler in Germany, where the disciple in every way surpassed the master, with what tragic results for mankind the world will never forget.

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Fascists, BRITISH UNION OF. Political party formed by Sir Oswald Mosley (*q.v.*) in 1931 after the collapse of his New Party (*q.v.*). Organized on German-Italian fascist lines, the B.U.F. was anti-Jewish and sought to introduce the leadership principle into government. Members wore a black uniform, used the Nazi-fascist salute with upraised arm, and sang the Horst Wessel song with an English text. The badge was a lightning flash surrounded by a circle. The B.U.F. caused serious disturbances by uniformed marches through the East End of London, members bearing anti-Jewish slogans, and in 1936 the Public Order Act forbade the wearing of political uniforms. A split occurred in 1937, when William Joyce (*q.v.*), formerly director of B.U.F. propaganda, and others broke away to form the National Socialist League.

Early in the Second Great War the union organized a campaign for concluding peace with Germany. On May 23, 1940, the police raided its headquarters in Westminster and arrested 34 members, including Mosley. The union was banned, July, 1940, and its leader and other members interned under defence regulation 18B (*see* Defence Regulations). In 1946 it was stated in the house of commons that before the war the Italian government subsidised the B.U.F. to the extent of £60,000 a year.

Fasher, EL. Town in the Anglo-Egyptian Sudan. Capital of Darhur province, it lies about 200 m. W. of El Obeid, and is a junction on the Sudan government rlys. and the centre of caravan trade.

Fashion (Lat. *factio*, making; through old French *fachon*, method or *mode* of making). Without losing its general meaning, the word fashion has now acquired so close a relationship to the changing modes of clothing, particularly feminine clothing, that standing by itself it is taken to mean nothing else. The origins of feminine fashion have been examined throughout the centuries, largely by male (and frequently disapproving) observers. There exists a considerable literature on the subject, covering diverse considerations fanning out into psychology, history, sociological ideas of modesty, and the unsolved

problem of what constitutes beauty and good taste.

Fashion in the present period of organized commerce in dress, when the trade must both create and meet a demand, has one constant characteristic: it must change; and to serve this end producers of clothing have in the last hundred years drawn all branches of the cloth-making and allied trades into cooperation. This movement began in France, which has for centuries enjoyed a particular prestige in all that concerns feminine dress.

British producers of dress are now following the same method, which involves the close working of dress designers with spinners and weavers. The technique of designing for fabrics is intricate, as yarn suitable for one cannot be successfully woven into another. There are schools of instruction, and the successful designer is one who is thoroughly acquainted with the theory and practice of dyeing, spinning, and weaving.

Introduction of the Short Skirt

Since the French Revolution, changes of fashion have been dictated chiefly by leading dress-makers. Their power has naturally been principally exercised to secure prosperity for their trade, rather than for any aesthetic ends. Thus, when war broke out in August, 1914, women were wearing long, narrow (hobble) skirts. Early in 1915 the dressmaking dictators of Paris, afraid that women would buy fewer clothes in the interests of economy, introduced shorter and very wide skirts. The markets were flooded with these to such an extent that by 1916 a woman in a pre-war skirt found herself unpleasantly conspicuous in the street.

The great expansion of the ready-made clothing trade after the First Great War improved public taste, giving a certain self-confidence to the average woman in her ideas about clothes, and the big dressmaking groups have found their dictates ignored on occasion. Tight-lacing, boned collars, boned bodices, and other restricting features of dress never returned after 1918, though attempts were made from time to time to introduce them again, for the benefit of the manufacturers of the accessories which such styles demand. In 1930 ankle-length skirts for outdoor wear were launched on the fashion market; women would have nothing to do with them, though they accepted long-skirted evening dresses. Good

taste was still further stimulated in the public by the employment of recognized experts in the designing of Utility (*q.v.*) clothing during and after the Second Great War.

The influence of the films on women's dress is great; but, while the fashions worn by film-actors are extreme, economic and other reasons lead to their modification before they are offered to the public. The fashion press, an extremely popular form of reading, devotes itself principally to extreme modes. Its attraction, however, is comparable to that "window-shopping" which is a habit of many women with limited purses.

An admirable summary of fashion and its influences is Miss Thalassa Cruso's introduction to the London Museum catalogue, Costume Section. See Costume; Dressmaking; Shoe; Skirt, etc.

H. Pearl Adam

MASCULINE FASHION. Fashion in male attire is evolutionary rather than subject to external dictation, and the changes are therefore slower and less perceptible. The last radical change in W. Europe was that from knee breeches to trousers at the end of the 18th century. During the 19th century the skill of the English, and especially London, tailors in the making of suits from the heavier cloths demanded by the conditions of industrial urban life established an ascendancy and set the standard for Europe and America, and even for the Far East, where the wide adoption of European dress at the expense of traditional native costume was an indirect tribute to English tailoring. London still sets the standard, one of quality rather than fashion, and unconscious rather than deliberate.

The basis of men's wear has remained the same for 150 years: hat, overcoat, coat, waistcoat, trousers. The shapes have varied in detail, giving rise to such transient extravagances as the shepherd's-plaid trousers of the 1850s or the "Oxford bags" of the 1920s. Sometimes bright colours are favoured, sometimes the tendency is towards sombre hues. Commercial enterprise may popularise certain minor adjuncts, *e.g.* straw boaters, cummerbunds, spats, suède shoes, but cannot ensure their endurance. Other modifications have sometimes been introduced in emulation of the idiosyncrasies of a public or popular figure of the day (*e.g.* Beau Brummell, Lord Raglan, Edward VII, the duke of Windsor,

Anthony Eden), but such emulation has been both voluntary and capricious. The result of any attempt to impose a new fashion is well exemplified in the failure of the Sandringham (or Daily Mail) hat, introduced 1919-20. Masculine taste shrinks from sudden novelty. Such changes as occur have usually been first thoroughly established in less formal garb, such as sports wear or undress service uniform. For the rest, much depends on the materials and their price, but even more, in Great Britain, on masculine subservience to the unwritten canons, taboos, and prejudices of "good form," which even on such matters of sartorial etiquette as the avoidance of brown shoes with a navy blue suit or the disregard of the lowest waistcoat button is not to be lightly altered or transgressed.

Comfort and Informality

The general direction of evolution has been steadily towards greater informality and comfort. Thus the coat has gradually become a jacket, the vent at the back, which disappeared after the First Great War, marking the last vestige of tails; silk hat and bowler have given place to the soft felt hat—or to none; collars once high and stiff have become low and soft; the elaborate stock has become a simple knotted tie; boots have become shoes. A second tendency has been towards the elimination of social distinction in dress by the mass production of ready-made clothing.

In the matter of whiskers, beards, and moustaches, fashions have changed more swiftly and often inexplicably. But the beards grown during the Crimean war may be held responsible for those of two whole generations of Englishmen; Lincoln's goatee was widely copied in the U.S.A.; and at least two film actors, Chaplin and Colman, helped to establish moustache styles in two continents. Nevertheless, masculine independence is demonstrated in the fact that beards were never less worn in Great Britain than throughout the reign of George V, a popular, yet bearded monarch.

Consult Taste and Fashion, J. Laver, rev. edn. 1945.

Gordon Stowell

Fashoda Incident. Name given to an episode which occurred just after the British reconquest of the Sudan in 1898. A small French expedition under Major (afterwards General) Marchand made its way from the French Congo to Fashoda (now Kodok), occupying it on

Sept. 7, in spite of the fact that in 1895 the British government had given formal notice that the Nile valley was within its sphere of influence. Sir Herbert Kitchener, then sirdar, went at once to Fashoda and asked Marchand to withdraw. The French officer refused, but on Nov. 5, after further negotiations, his government ordered him to give up the post. By an agreement signed March 21, 1899, France undertook to withdraw from the Nile valley, and a new boundary between the areas protected by the two countries was outlined. The affair caused much excitement in both countries.

Fast and Loose. Dishonest game formerly much played by gipsies and tricksters, known also as prick the garter. The victim was invited to push a pin or bodkin through a folded belt so as to fix it to a table, but the folds were so disposed by the owner that on the ends being pulled it came free, and the stake was forfeit. From this came the expression "to play fast and loose," *i.e.* to repudiate expressed obligations which it is no longer convenient to acknowledge.

Fast Castle. Ruined fortress of Berwickshire, Scotland. It stands on a steep cliff about 3½ m. N.W. of St. Abb's Head, and was formerly a stronghold of some importance, though little now remains of the buildings. It was to Fast Castle that James VI of Scotland was to have been brought by the Gowrie conspirators, and it is described as Wolf's Crag by Scott in *The Bride of Lammermoor*.

Fast Colours. Broadly speaking, colours which behave satisfactorily in wear for a reasonable time—say, six months. Colours should be fast against sunlight and water, rubbing, the action of street mud, and of perspiration. Colours are frequently required to be fast against specific finishing or manufacturing processes, *e.g.* against milling and potting. See Dyes.

Fasti (Lat. *fas*, divine law). Latin word meaning lawful, applied to those days (*dies fasti*) in the year on which legal business could be done, as opposed to days on which it could not (*dies nefasti*). The word then came to mean a calendar. Such calendars were of two kinds: *Fasti diurni*, a calendar indicating religious festivals, market days, etc.; *Fasti annales*, a calendar giving the names of the magistrates for the year and the chief events.

Fasting (A.S. *faestan*, to hold fast, observe). Total or partial abstinence from all or special kinds

of food and drink. Such abstinence has been practised for religious or other reasons by people of all nations from early times. It has formed part of both pagan and Christian asceticism (*q.v.*), in a religious sense being enjoined or commended together with prayer and almsgiving, and regarded as a method of self-discipline which, controlling the animal appetites, enables the mind more clearly to apprehend spiritual truths.

The Mosaic law prescribed one great fast day in the year, the Day of Atonement or 10th day of the 7th month (Lev. 16); others were added in commemoration of events connected with the captivity (Zech. 8); and in the O.T. many instances are recorded of individual and communal fasting. The king of Nineveh, when Jonah prophesied its fall, proclaimed a general fast, and the city was spared (Jonah 3). In the N.T. Jesus Christ is represented not as enjoining His disciples to fast, but as teaching that, whenever fasting was undertaken, it was to be without ostentation and with purity of intention (Matt. 6). At the same time He indicated that it would be a duty after His departure (Matt. 9; homily On Fasting ii); and said of certain demons (Mark 9, A.V.): This kind can come forth by nothing but by prayer and fasting (R.V. omits "and fasting"). Fasting was recommended and practised by the apostles (Acts 13, 14; 2 Cor. 6, 11). In the early church fasts were kept on Wednesdays and Fridays, and during Lent.

The Rules in the Churches

Unlike the R.C. Church, the Church of England makes no distinction between fasting and abstinence (see Abstinence, Days of). In the homily On Fasting, the custom is said to be of itself a thing merely indifferent. It is regarded not as a means of grace but as a preparation for the means of grace, and is voluntary, and the rule, obligatory among Roman Catholics as to partaking of the Holy Communion fasting, is observed only among High Church Anglicans. The proclamation of 1548 for the abstaining from flesh in Lent time (2 and 3 Edward VI, c.19) was issued for political and economic reasons. At the same time, the Book of Common Prayer enumerates as days of fasting or abstinence the 40 days of Lent, Ember days, Rogation days, all Fridays except Christmas Day, and the evens or vigils of certain festivals where these festivals do not fall on a Monday, Sunday never being a fast day.

The manner of fasting or abstinence is left to the individual.

In the Roman Catholic Church all baptized persons who have completed their 21st year are bound to observe the days of fasting, on which they may not eat more than one full meal, this meal to be without flesh meat, and to be eaten after mid-day. The days of fasting are all Lent, except Sundays, the Ember days, vigils of the more

tion of life under such conditions varies within wide limits. Instances are well authenticated of survival for upwards of forty days if water is freely taken. The lord mayor of Cork, Terence MacSwiney, in 1920 fasted in Brixton prison, dying, after abstaining from food for 73 days, on Oct. 25. After a prolonged fast the stomach is unable to exercise its functions normally, and at first very small quantities

of liquid and easily digested food should be given. Limited fasting forms part of many nature cures. See Hunger Strike; Starvation.

Fastnet. Rock off the S.W. coast of co. Cork, Eire. It has a lighthouse showing a flashing light visible for 18 m.

Fat. Chief constituent of fatty or adipose tissue, which is present to a varying extent in nearly all parts of



Fastnet, Eire. An air view, showing lighthouse (completed 1907) and base of an earlier, demolished lighthouse

solemn feasts, *i.e.* Pentecost, the Assumption of the Virgin Mary, All Saints, and Christmas. Fasting has always been exceptionally strict in the Eastern (Orthodox) Church, in which 226 days are set apart for it in the year; it is an important religious duty among the Hindus; and among Mahomedans, who regard the practice as mitigating the penalties of sin, the month of Ramadan (*q.v.*) is a period in which fasting is obligatory. In ancient Greece rigid fasts preceded the solemnities of the Eleusinian mysteries; and in Rome every fifth year a general fast was held in honour of Ceres.

From a physiological or medical point of view, abstention from food leads to the tissues of the body being consumed in order to maintain the output of heat and energy. Hence, progressive emaciation occurs, absorption of the fat in the tissues being well marked. The face becomes pale, the cheeks sunken, and the eyes hollow. The abdomen sinks in and the bones become prominent. The temperature is often subnormal.

Towards the end, mental symptoms may appear and hallucinations may be followed by coma and death, the immediate cause of which appears to be reduction of the bodily temperature. The dura-

the body. Adipose tissue consists of a foundation of connective tissue in the meshes of which are the fat-cells containing an oily material which is a mixture of palmitin, stearin, and olein formed by combination of fatty acids with glycerol. Chemically, fat consists of carbon, oxygen, and hydrogen, and it provides a reserve of material which can be drawn upon to maintain the heat and energy of the body. See Obesity; also Fatty Acids; Fatty Oils, etc.

Fatalism (Lat. *fatum*, fate). View that all the events of human life are ordained beforehand by an absolute necessity. Such was the view of Epicurus and the Stoics, and it is held by Mahomedans at the present day. Fatalism differs from determinism, according to which events stand in a relation of cause and effect to other events immediately preceding, in that it asserts that, no matter how much the antecedent causes may be varied, it will not affect the pre-ordained result. See Free Will.

Fata Morgana. Form of mirage seen in the straits of Messina between Sicily and Calabria, supposed to be the work of a fata or fairy named Morgana. In this type of mirage, which is seen across calm water, inverted images of ships, etc., are seen in the air

above the real objects. The term is used to describe a mirage (*q.v.*).

Fat Boy, THE. Character in Dickens's *Pickwick Papers*. Page-boy to Mr. Wardle, Joe is enormously fat, given to somnolence, and often quoted for his desire to "make your flesh creep."

Fatehganj. A village of the Uttar Union, India. In the district of Bareilly, it is 23 m. S.E. of Bareilly, and was founded to commemorate the British victory over the Rohillas in 1774. A few miles N.W. in the same district there is another village of this name, where the Rohillas were defeated by the British in 1796. Pop. 4,200, two-thirds Hindus.

Fatehgarh. Town of the Uttar Union, India. The headquarters of Farukhabad district, it forms with Farukhabad city, 3 m. to the N.W., a single municipality. The fort near the Ganges was built in 1714 by Nawab Mahommed Khan. A monument commemorates the European residents who lost their lives in the Mutiny of 1857. See Farukhabad.

Fatehpur. Dist. and town of the Uttar Union, India, in the Allahabad division. The area of the district, which lies between the Ganges and the Jumna, is 1,642 sq. m. Slightly more than half the district is under cultivation, the chief crops being gram, barley, wheat, rice, and cotton. Fatehpur town is on the Eastern railway. Pop. (1951) district, 908,985; town, 24,301.

A second town of the same name, which is situated in the Barabanki district of the Uttar Union, 35 m. N.E. of Lucknow, is noted for its old buildings, some of which tradition assigns to the 14th or 15th century. Pop. (est.) 7,500.

A third town of the same name is in the Sikar district, Jaipur division, of Rajasthan. It is 90 m. N.W. of Jaipur. Pop. (1951) 26,751.

Fatehpur Sikri. Town of the Uttar Union, India. It is 23 m. W.S.W. of Agra city, and was founded in 1569 by the Mogul emperor, Akbar, to whom the saint Salim Chishti foretold the birth of a son (the emperor Jehangir). A wall six miles long runs along three sides of Akbar's town. The modern town lies near the western end. Prominent among the buildings are the mosque with Salim Chishti's mausoleum in the quadrangle, the palace named after Akbar's Rajput wife, and his own palace and audience halls. Pop. (est.) 7,500.

Fates. In classical mythology, goddesses who presided over the destinies of men. By the Greeks they were called Moirai, by the Romans Parcae. They were three in number, and were daughters of Zeus and Themis, or daughters of Night and Erebus. Clotho, the youngest of the three sisters, held the distaff which spun the thread of life; Lachesis mixed good and evil fortune with it; Atropos cut the thread at the allotted moment. They were very powerful goddesses, with whose decrees even Zeus himself was unwilling to interfere. In art the Fates are generally represented as aged women, but sometimes as maidens of grave mien: Clotho with a distaff or book of fate; Lachesis pointing with a staff to a globe; Atropos with a pair of scissors or a pair of scales.

Father. Word common to most Indo-European languages, the forms of which differ slightly in accordance with phonetic laws. Originally denoting a male parent, then by extension a remoter relationship such as ancestor or forefather, it came to be applied to the inventor or first person prominent in any art or pursuit. Thus, the Greek historian Herodotus is popularly called the father of history. Father is also a term of respect, as conscript fathers for the senators of ancient Rome; father of his country for Cicero, Augustus, and other emperors; father Thames and father Tiber. Special applications are the Pilgrim fathers, the first settlers in North America; father of the house, he whose membership of the house of commons has been longest without a break; father of the chapel (*q.v.*). In theology, Father is used for the Supreme Being, the First Person of the Trinity; for a priest of the Roman Catholic Church; and for the earliest Christian writers. In Rome the father of the family had very wide powers over his children and household. See Family; Fathers of the Church; Patria Potestas.

Fatherhood. Theological term for one aspect of the relationship of God to the universe generally, and to man particularly. In most ancient religious systems the idea of paternity, usually associated with that of maternity, is connected with the Deity or the chief of the deities worshipped. In monotheistic systems the ideas of paternity and maternity are combined in one God who is the cause and progenitor of all existence.

In Christian theology the term father is applied to the First Person of the Trinity as expressing

both a special relationship to the Son and an attitude as Creator, sustainer, and chief benefactor of the human race. This aspect of God as the Father of His people was only gradually unfolded in the Hebrew Scriptures, and it was not until post-exilic days that the idea of a warrior king appears to have been superseded by that of a loving and merciful Father. The teaching of Christ developed the doctrine to a degree unknown before. He claimed to be in a special sense the Son of God, and in Him all Christians are the children of God by adoption and regeneration.

Father Lasher. A member of either of two species of fish, *Cottus bubalis* or *C. scorpius*, small sea fish of the order Scleroparci.

Father of the Chapel. Name given to one who presides over the meetings of employees in a printing or newspaper office. See Chapel.

Fathers of the Church. Term specially applied to early Christian writers pre-eminent for learning and sanctity, whose works are regarded as having authority next after that of the Bible. The name seems to have been generally accepted by the 4th century. It has, however, always been used rather loosely. Even writers like Origen, whose orthodoxy was open to dispute, have been included among those who are known as fathers of the church.

The prominent writers of the 1st century were known as the apostolic fathers from their personal association with the apostles, whose teachings they are held to reflect. The list of the church fathers has been held to include writers down to the 12th century; but in common practice it is restricted to those antecedent to S. Gregory the Great (A.D. 604) in the Western Church and to John of Damascus (A.D. 756) in the Eastern. Some authorities, however, regard S. Bernard of Clairvaux (d. 1153) as the last of the fathers.

The chief church fathers are usually divided as follows: *Doctors of the church*—Athanasius, Basil the Great, Gregory Nazianzus, Chrysostom, Ambrose, Augustine, Jerome, and Gregory the Great; *Ante-Nicene Fathers*—Justin Martyr, Clement of Alexandria, Origen, Tertullian, Irenaeus, Cyprian, Gregory Thaumaturgus; *Post-Nicene Fathers*—Eusebius, Cyril of Jerusalem, Gregory of Nyssa, Theodoret, Hilary of Poitiers, Hilary of Arles, Leo the Great, John of Damascus, and others. The Venerable Bede is included in the last category.

In the Roman Church, the fathers, in their testimony to the fundamental doctrines of the faith, are held to be without fault, and their teaching is to be accepted without question; but in details and method of teaching they are of varying authority and value. Among Protestants no such authority is assigned to them; but the general consensus of the fathers is regarded as of the highest importance as showing how the early Church understood the teaching of Christ and His Apostles. The writings of all the chief fathers of the Church are included in Migne's edition, in 387 large volumes, 1844-66; and most of them have been translated into English.

Fathom. Nautical measure 6 ft. in length. Cables, etc., are measured by the fathom, and lead lines are marked off in fathom spaces.

Fatigue. Condition produced by prolonged or excessive output of activity, due partly to consumption of the available energy-producing materials, and partly to the accumulation in the tissues of the waste products formed during these efforts. The physiology of fatigue in a single muscle can be studied graphically with the aid of the muscle-nerve preparation, obtained by dissecting out the gastrocnemius muscle from the leg of a frog with the nerve attached. In the living being, besides the changes in the muscles, the development of fatigue is increased by the exhaustion of the central nervous system which follows the accumulation of waste products in the blood. Mental or emotional fatigue, however real, can scarcely be measured, though it was studied in both Great Wars.

Fatigue. In metallurgy, term used to describe the effect on metals of repeated stresses. Metals possess easily measured limits of elasticity and strength and, under normal conditions, they will not fail unless these limits are exceeded. But if a much lower stress, about half the ultimate tensile stress, be applied repeatedly, either being reduced to zero or reversed between applications, the metal becomes fatigued and does eventually fail.

Failure starts at one or more points where stress becomes concentrated; these may be slag inclusions, tool marks, sharp fillets, oil holes, corrosion pits, etc. The hair-line crack proceeds along the amorphous material at the boundaries of the metallic grains or in slip bands. After some period, these fine cracks reduce the

effective cross-section of the article. An examination of the broken surface of such a failure shows two quite different areas; there is a portion comparatively smooth and discoloured, while the rest of the surface appears either fibrous or crystalline, because of the final tearing of the unaffected metal, which can no longer bear the load. This type of rapidly alternating stress is commonly met with in practice, so it is essential for the engineer to have a method of measuring the susceptibility to such stresses of different metals and alloys. A number of similar test pieces must be subjected to different stresses until fracture occurs or until the number of reversals exceeds ten millions, when the stress is assumed to be within the fatigue limit. Generally steels with a higher tensile stress have greater resistance to fatigue, but local concentrations of stress upset this relationship. Fatigue under conditions favouring metallic corrosion is usually more rapid than failure due to fatigue under normal conditions.

Fatigue (Fr. *fatiguer*, to weary). Military term applied to duties as distinct from the use of arms. Normally fatigues are duties performed by troops in connexion with administration of camps and barracks, and include carrying coal, loading baggage, cleansing surface drains and flushing latrines, sweeping yards, clearing snow, moving ammunition, carrying water, etc. Men engaged on fatigues are known as a working party. Fatigues form part of the punishment of men confined to barracks or undergoing detention.

Fatima (c. 606-632). Daughter of Mahomet by his first wife Kadijah. Born at Mecca, she was the prophet's favourite daughter, and was called by him one of the four perfect women in the world. She bore her husband Ali three sons, Al-Hassan, Al-Hussein, and Al-Muhsin. From the first two are descended the Fatimide caliphs of N. Africa and Syria.

Another Fatima was the heroine of Perrault's story of Bluebeard, where, as his last wife, she discovered the bodies of her predecessors. (See Bluebeard.) The name also occurs as that of an enchantress in the Arabian Nights story of Sindbad the sailor.

Fatshan. City of China, in the prov. of Kwangtung. It lies in the Si-Kiang and Pe-Kiang delta, 7 m. S.W. of Canton. It has iron and steel industries, and a trade in cereals, oil, timber, and cassia. At

Fatshan Creek, a number of Chinese junks were destroyed by British naval forces during the war of 1857. Pop. est. 400,000.

Fatty Acids. Series of monobasic acids with the general formula $C_nH_{2n}O_2$, so called because many of them occur in natural fats. (See Fatty Oils.) They are colourless liquids or solids, the lower members of the group possessing a sharp smell and sour taste. The formula given above requires the number of hydrogen atoms to be double the carbon atoms in each acid. The following is a list of fatty acids, arranged in order of their carbon atoms:

CH_3O_2	— Formic
$C_2H_4O_2$	— Acetic
$C_3H_6O_2$	— Propionic
$C_4H_8O_2$	— Butyric
$C_5H_{10}O_2$	— Isobutyric
$C_5H_{10}O_2$	— Valeric
$C_6H_{12}O_2$	— Isovaleric
$C_6H_{12}O_2$	— Methylethylacetic
$C_7H_{14}O_2$	— Trimethylacetic
$C_8H_{16}O_2$	— Caproic
$C_9H_{18}O_2$	— Oenanthylic
$C_{10}H_{20}O_2$	— Caprylic
$C_{11}H_{22}O_2$	— Pelargonic
$C_{12}H_{24}O_2$	— Capric
$C_{13}H_{26}O_2$	— Undecylic
$C_{14}H_{28}O_2$	— Lauric
$C_{15}H_{30}O_2$	— Tridecylic
$C_{16}H_{32}O_2$	— Myristic
$C_{17}H_{34}O_2$	— Isocetic
$C_{18}H_{36}O_2$	— Palmitic
$C_{19}H_{38}O_2$	— Daturic
$C_{20}H_{40}O_2$	— Stearic
$C_{22}H_{44}O_2$	— Arachidic
$C_{24}H_{48}O_2$	— Behenic
$C_{26}H_{52}O_2$	— Lignoceric
$C_{28}H_{56}O_2$	— Carnaubic
$C_{30}H_{60}O_2$	— Hyaenic
$C_{32}H_{64}O_2$	— Cerotic
$C_{36}H_{72}O_2$	— Melissic

The fatty acids may be roughly divided into two classes, liquid and solid. Those containing ten or more atoms of carbon are solids. All dissolve readily in alcohol and ether. The lower members of the series are soluble in water, but the solubility decreases as the number of carbon atoms increases. The acidity diminishes with the increase in the carbon atoms, this property being utilised in a process for separating the various acids. Another process of separation depends upon the progressive decrease in the solubility of the barium, magnesium, and lead salts. All the fatty acids, except formic and acetic, are oily or greasy. The boiling-point rises about 19° for each addition of CH_2 in the formula, in acids from formic to capric. The melting points of the solids show a similar rise. The volatility of the acids decreases as the carbon atoms increase, so that lauric acid and those higher in the series can be distilled with-

out decomposition only under diminished pressure. The acids with an odd number of carbon atoms are comparatively rare.

Fatty Compounds. In organic chemistry, those in which the carbon atoms are connected together by a single linking. They are also known as saturated compounds because chemical changes are brought about by substituting one atom or group by other groups. Another series of organic compounds containing less hydrogen than the fatty compounds are known as unsaturated compounds, as they can combine directly with hydrogen or chlorine. The fatty acids belong to the group of fatty compounds.

Fatty Degeneration. Change in the cells of animal tissues in which the constituents of the cell become partly broken down into fat. It may be the result of various diseases, *e.g.* pernicious anaemia, or poisoning by certain substances, such as phosphorus or arsenic, or, more frequently, may follow lessening of the blood supply to an organ owing to narrowing of the arteries. The last is the usual cause of fatty degeneration of the heart.

Fatty Oils (formerly called fixed oils). Oils which, unlike hydrocarbon and essential oils, are not volatile without decomposition and cannot be distilled in steam from the raw materials in which they occur. On treatment with caustic alkali fatty oils, unlike others, form soaps. They are neutral bodies, and when pure are almost tasteless and odourless. Virtually insoluble in water and with the exception of castor oil, in cold alcohol, they are soluble in ether and petroleum spirit, and are mutually soluble, the one in the other. Since only fatty oils are digestible, they are the only fats to enter into human diet.

Chemically, fats and fatty oils are mixtures of mixed triglycerides, a triglyceride being a compound in which one molecular portion of glycerol is combined with three molecular portions of fatty acids, usually different ones. These acids are the saturated or unsaturated acids of the paraffin and allied series, and among the commonest are lauric, palmitic, stearic, and oleic acids. There is no chemical difference between a fat and a fatty oil, the term fat being reserved for such individual members as are solid, the term fatty oils for those which are liquid at ordinary temperature. The fat becomes fatty oil by heating, the change being reversed by cooling.

Fats occur throughout the tissues of animals and plants, form a homogeneous group, and are classified as follows: (a) animal fats, such as beef and mutton tallow and hog lard: these are derived from the fatty tissues of cattle, sheep, and pigs; (b) milk fats, such as butter fat and ghee: the former is derived mainly from the milk of the cow, the latter from that of the goat; (c) fish and marine animal oils: from the blubber of the large marine animals, such as the whale and the seal, from cod, herring, salmon, menhaden, and from the livers of halibut and cod; (d) vegetable oils and fats derived from fruit coatings and seeds of many plants and trees. The principal fruit coating fats are palm oil and olive oil, the principal vegetable seed oils being linseed, cottonseed, groundnut, soya, sunflower, rapeseed, coconut, with lesser amounts of palm kernels, sesame, hempseed, and castorseed. The oil content of these oilseeds varies: it is 63 per cent in the case of copra, 45 per cent in palm kernels, 15 per cent in soya beans.

World production of these fats and fatty oils is some 20 million tons a year, made up of three million tons of butter, four million tons of lard and tallow, 12½ million tons of vegetable fats and fatty oils, and 500,000 tons of marine animal and fish oils. Not all oil-bearing produce enters into world trade, a great deal being consumed in the countries of origin. This applies particularly to large quantities of soya beans, groundnuts, sunflower seed, sesame grown in China, to soya beans grown in Manchuria, to much of the oilseed crop in India, and notably to palm oil produced in W. Africa.

Countries of Origin

Soya beans are produced mainly in Manchuria, China, U.S.A.; cottonseed in U.S.A., Egypt, India, S. America, and Russia; linseed in U.S.A., Canada, India, Argentina; palm oil and palm kernels in W. Africa, Malaya, and the E. Indies; copra in India, Ceylon, Sumatra, Philippine Islands; sesame in India and China; groundnuts in China, W. Africa, India, U.S.A.; olives in Spain and other Mediterranean countries. Cod oil and cod liver oil come from Newfoundland and Norway; tallow from U.S.A., Argentina, Australia, New Zealand; while the main producing and exporting country of lard is the U.S.A.

Animal fats are produced generally by a process of rendering in

which the fatty material is heated in open kettles or closed autoclaves. Oilseeds and kernels, after shelling, crushing, grinding, and moulding of the resultant meal, are then subjected to hydraulic pressure between open plates or in enclosed cylindrical cage presses. A cold-pressed oil results; sometimes the residual cake is hot-pressed to remove further oil. The oil cake that remains, containing from 7 to 10 per cent of oil is used to feed cattle. Oils are also extracted from oilseeds and kernels by the use of a volatile solvent, preferably a petroleum fraction. In this case the residual meal may contain as little as 1 p.c. of oil; it is used in making compound feeding stuffs and in some cases as a fertiliser. However extracted, vegetable oils usually require filtering, refining, bleaching, and deodorising, particularly if they are to be eaten.

Uses of Fats and Fatty Oils

Fats and fatty oils are essential human food, the most important edible ones being: (1) butter, which exists in milk and is obtained by churning, and is usually taken raw; (2) lard, used in pastry and bread making and other cooking; (3) cacao butter, derived from the cacao bean and used in making chocolate and confectionery; (4) margarine (made from vegetable and whale oils), lard compounds, and shortenings; (5) vegetable oils (chiefly olive and cottonseed) used in frying.

Animal and vegetable fatty oils are used in soap making; hard soap is made by boiling tallow, palm oil, some hydrogenated fats, coconut oil, and such soft oils as cottonseed and soya bean oils along with resin and caustic soda. Soft soaps are made from linseed and cottonseed oils, caustic potash being used in place of caustic soda. In making hard soap, after removal of excess of alkali and separation of the soap, the resultant liquors contain weak glycerine, which is evaporated and refined to produce refined glycerine.

Fats can also be broken up into glycerine and their fatty acid constituents by treatment with super-heated steam, and in this way a better grade of crude glycerine is obtained, while the resultant fatty acids find an outlet in the candle, polish, and other industries. For the manufacture of toilet soaps and shaving soaps, high-grade tallow, bleached palm oil and coconut oil are preferred.

Linseed oil, China wood oil (Tung oil), perilla, and sometimes

soya bean oil are used in the making of paints and varnishes. These oils, usually termed drying oils, by absorption of atmospheric oxygen dry to a solid elastic skin; their drying is facilitated by first boiling the oils with small amounts of lead, manganese, and cobalt salts, known as driers. Rape or colza oil as an illuminant, though less common than formerly, is still important in regions of the world remote from supplies of kerosene, gas, or electricity. Oils from whale, seal, and cod are used in jute batching, in the treatment of textile fibres, and in leather dressing. Castor, cod liver, and chaulmoogra oils have long been valued for their medicinal properties; and castor oil is further of very considerable value in the manufacture of turkey red oil in the dyeing industry and as a lubricant in internal combustion engines. See Essential Oils; Paint; Soap, etc. Consult also Oils, Fats, and Fatty Foods, E. R. Bolton, 2nd edn., Vegetable Oils and Oilseeds, Imperial Economic Survey, 1938; Utilisation of Fats, H. K. Dean, 1938; Industrial Fats and Waxes, T. P. Hilditch, 2nd edn., 1941; Review of the Oilseed, Oil, and Oilcake Markets, Frank Fehr and Co., 1944.

H. M. Langton

Faubourg. French word for a suburb, e.g. the Faubourg St. Honoré in Paris. It comes from Latin words meaning outside the borough or burg, and in the days when cities had walls was given to suburbs outside them.

Faucher, LÉON JOSEPH (1803-54). French economist and politician. Born at Limoges, Sept. 8, 1803, he became prominent as a journalist, chiefly on *Le Temps* and *Le Courrier Français*, between 1830-42, making a close study of economic problems and exerting a moderating influence on the liberal factions. Elected a deputy in 1847, he was also returned to the constituent assembly of 1848 for the Marne dept. He was a strong advocate of free trade principles, influenced by a visit to England in 1843. Although minister of the interior in 1848-49, and again in 1851, his active political career was not successful, and he retired from public life in protest against the adoption of universal male suffrage in 1851. He was largely responsible for the foundation of the *Crédit Foncier* (q.v.) in 1852. He died Dec. 14, 1854.

Fauchet, CLAUDE (1744-93). French Revolutionist. Born at Dornes, Nièvre, Sept. 22, 1744, he

became a priest in Paris and tutor in a noble family. His preaching won fame for him, and after being dismissed from his position as court preacher he joined the Revolutionary party. He helped in the attack on the Bastille, and was afterwards a member of the legislative assembly and the national convention. He was made bishop of Calvados, but, ceasing to act with the advanced republicans, he was guillotined, Oct. 31, 1793.

Faucille, COL DE LA. Mt. and pass of France, in the dept. of Ain. They are in the Jura Mts., 16 m. N.W. of Geneva. On the summit of the mountain (4,355 ft.) are two hotels. The pass leads through the valley of the Dappes, which in 1862 was partitioned between France and Switzerland.

Faucit, HELENA SAVILLE (1820-98). British actress. She made her first London appearance at Covent Garden on



Helena Faucit,
British actress

Jan. 5, 1836, as Julia in Sheridan Knowles's *The Hunchback*, and achieved conspicuous success as Juliet, Portia, Constance, Desdemona, Imogen, and Hermione. Macready engaged her as leading lady from 1837 at Covent Garden, The Haymarket, and Drury Lane. She acted Pauline to his Claude, Julie to his Richelieu, and Clara to his Alfred Evelyn, in the original production of Lytton's plays, *The Lady of Lyons*, *Richelieu*, and *Money*. In 1851 she married Sir Theodore Martin, who wrote her life, 1900. She died Oct. 31, 1898.

Fauconberg, BARON. English title dating from 1283. Walter de Fauconberg, who was summoned to parliament as a baron in 1283, was the first holder, and the title passed to his descendants until it came in 1362 to Thomas, the 5th baron. He left an only daughter, Joan, who married Sir William Neville, and he, following the custom of the time, became Lord Fauconberg, later becoming earl of Kent. He and Joan had two daughters, but no son; and when his widow died in 1491 the barony fell into abeyance between her two grandsons.

In 1627 Charles I gave Thomas Belasyse the title of Baron Fauconberg, and in 1642 created him a viscount. To these titles his grandson succeeded in 1652. A parliamentarian, he married Mary,

daughter of Oliver Cromwell. He became a courtier under Charles II, was made an earl in 1689, and died without an heir in 1700.

The original barony, called out of abeyance in 1903 in favour of the countess of Yarborough (a descendant of Joan Neville), again fell into abeyance between her two granddaughters, only children of her eldest son, on his death in 1948, as did the barony of Conyers, called out of abeyance in favour of Lady Yarborough in 1892.

Faulhaber, MICHAEL VON (1869-1952). German prelate. This outstanding figure in the opposition of German clergy to the Nazi regime was born at Heidenfeld, Bavaria, March 5, 1869, and became a priest in 1892. He was professor at Strasburg university, 1903-11; bishop of Speyer, 1911-17; archbishop of Munich from 1917, cardinal from 1921. With historical learning and fearless spirit he early began to preach and write against Hitlerism; his Christmas sermons of 1933-34, collected and published in many languages, became famous. Died June 12, 1952.

Faulhorn. Mt. of Switzerland, in the canton of Berne. It is in the Bernese Oberland, 32 m. S.E. of Berne, between the lake of Brienz and the Grindelwald valley. It is composed of calcareous, friable schist. Alt. 8,803 ft.

Faulkner, WILLIAM (b. 1897). American novelist. Born at New Albany, Mississippi, Sept. 25, 1897, he was educated at Mississippi university, and his first book, *The Marble Faun*, was published in 1924. Faulkner was strongly influenced by his southern environment; with many writers of his generation he was indebted to James Joyce, and his style was tortuous yet flexible. With *The Sound and the Fury* he established himself as an important novelist. Later novels, in which he used new methods of construction, included *Light in August*, 1932; *Absalom Absalom*, 1936; *The Unvanquished*, 1938; *Go Down, Moses*, 1942; *Knight's Gambit*, 1951. The 1949 Nobel prize for literature was awarded to him in 1950.



William Faulkner,
American novelist

Fault. In geology, a fracture in the earth's crust along which the rocks on one side have been appreciably displaced relative to those

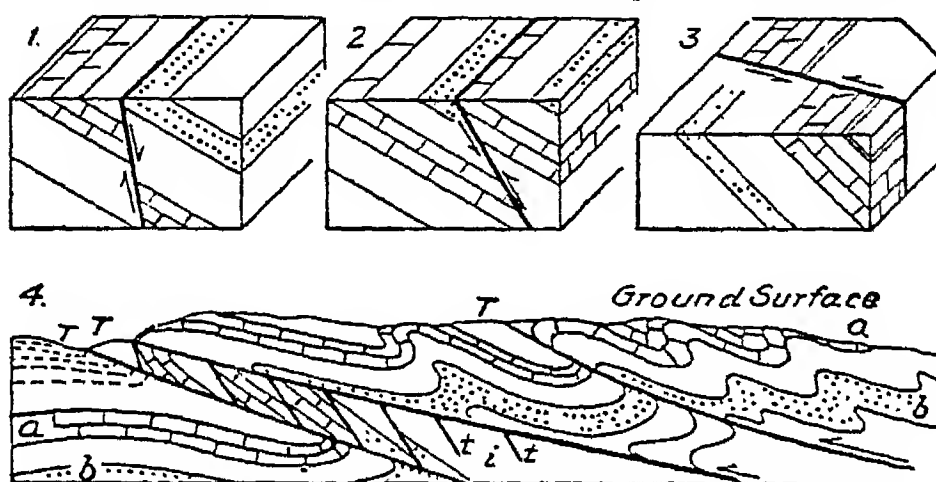
on the other. Faults are classified according either to their relation to the strata they traverse, or to the nature of the movement that has taken place. Thus dip-faults are parallel to the direction of dip of the strata which they cut; strike-faults are parallel to the strike or horizontal trend of the beds; and oblique-faults are between the two. The surfaces along which the movement has occurred are termed fault-planes; they are rarely vertical, and their inclination is measured either from the horizontal, when it is called the dip, or from the vertical, when it is called the hade. The upper surface of a fault-plane or zone is referred to as the hanging wall, and the lower as the foot-wall.

Where the rocks above the fault plane have moved downwards relative to those below it, the fault is said to be normal (Fig. 1). Where they moved upwards relatively, a reversed fault is produced (Fig. 2). When the inclination or dip of the plane becomes less than 45° , reverse

faults are usually termed thrusts. Many big thrusts occur on planes which dip very gently and may be slightly undulating; the Moine thrust in N.W. Scotland is a classical example. Relative movement between the rocks above and below big thrusts associated with mountain-building movements may measure tens of miles (Fig. 4). Tear-faults are faults on which the movement has been dominantly horizontal (Fig. 3). Numerous examples occur in the Scottish Highlands, where the Great Glen Fault, from Inverness to Loch Linnhe, is considered to have had a movement of 64 miles, in which the N.W. side moved S.W. relative to the S.E. side. The vertical component of fault movement is called the throw of the fault; the horizontal component is the shift.

Sudden movement on a fault sets up vibrations in the earth's crust and produces earthquakes (*q.v.*). Actual displacement of the ground surface by faults has been observed, the cliff so formed being called a fault-scarp. More common is the production of a cliff or slope feature along the fault by the erosion of softer rocks which have been thrown against harder. This

produces a fault-line scarp. Because faulting breaks up the rocks they are easily eroded along lines of faults; in this way fault-line valleys, such as the Great Glen are produced. Rift valleys are fault features formed by the sinking of a strip of ground between two parallel faults. Where rocks are broken into more or less cemented fragments a crush-breccia is formed; if this is ground to a clay it is called gouge. Faults sometimes form passages for ascending mineralised solutions, and so become the locus of ore deposition. They commonly act as channels for water, and the springs which occur along fault lines are



Fault. Diagram illustrating various types of geological fault. 1. Normal or gravity strike-fault. 2. Reverse strike-fault. 3. Transcurrent or tear dip-fault. 4. Section across a typical zone of thrusting. The beds a and b have been pushed upward and from the left on three subparallel major thrusts (T), and on repeated minor thrusts (t). The zone of minor reverse faulting is called a zone of imbrication (i)

of value for water supply. See Dip; Earth-movement; Tectonics.

Gilbert Wilson, Ph. D.

Faunus (Lat. *favere*, to favour). In Roman mythology, originally an Italian nature god, whom rationalistic explanations made out to be a prehistoric king. He was the patron of agriculture and of flocks and herds, and had prophetic powers. As the god of flocks, he was known as Lupercus, and the Lupercalia (Feb. 15) was celebrated in his honour. The Faunalia (Dec. 5) was rather a local festival. In art he is represented as a bearded man, with goatskin cape, and bearing a club and a horn.

Faure, FRANÇOIS FÉLIX (1841-99). French president. Born in Paris, Jan. 30, 1841, he made a fortune as a shipowner in Havre. He fought as a volunteer officer in the war of 1870-71 against Prussia, and entered the chamber as republican deputy for Havre in 1881. His knowledge of commercial and colonial conditions made him prominent, and he was under-secretary for the colonies in Jules Ferry's ministry of 1883, and minister of marine in 1894. He was elected president of the re-

public after Casimir-Férier's resignation, Jan. 15, 1895, defeating Brisson by 69 votes. An unsuccessful attempt on his life was made, July 14, 1896. The chief events marking his tenure of office were the visit of the tsar of Russia and the conclusion of the Franco-Russian alliance, 1896, and the beginning of the Dreyfus affair, at a critical point in which Faure died suddenly, Feb. 16, 1899.



Félix Faure,
French president

Fauré, GABRIEL URBAIN (1845-1924). French composer. Born at Pamiers, Ariège, May 13, 1845, he studied under Niedermeyer and Saint-Saëns in Paris. His first appointment was that of organist at S. Sauveur, Rennes; after holding similar posts in Paris, he became maître de chapelle at the Madeleine in 1896. During 1905-20 he was director of the Paris conservatoire. It was here that his work as a teacher was accomplished, his pupils including Nadia Boulanger and Maurice Ravel. Apart from his Requiem which must be accounted a masterpiece, Fauré's reputation rests upon his songs and chamber music. Among his lyrics are *Après un Rêve*, *En Prière*, *Les Roses d'Ispahan*, the collections *Le Jardin Clos* and *Mirages*, and his settings of Verlaine, notably *La Bonne Chanson*. His two sonatas for cello, trio for violin, cello, and pianoforte, quartet for strings, and two quintets for pianoforte and strings are standard works. He died in Paris, Nov. 4, 1924. There are studies by C. Koechlin, 1945; N. Suckling, 1946. *Pron.* Fo-ray.

Faure, JEAN BAPTISTE (1830-1914). French singer. Born at Moulins, Jan. 15, 1830, he excelled in singing as a boy. After studying at the Conservatoire in Paris, he appeared at the Opéra Comique in 1852, and achieved success in opera in Paris, London, Vienna, Brussels. He died Nov. 19, 1914.

Faust. German scholar of the 16th century whose name has become the centre of a great body of legend and poetry in European literatures. There is good historical evidence for the existence of a real doctor of this name who, during the first half of the 15th century, practised magical arts, and gained wide notoriety as a clever charlatan, especially, it is

believed, at Cracow. The numerous stories popularly attached to his name were collected anonymously and published by Johann Spiess at Frankfort in 1587 as *The History of Dr. Johann Faust*, a book which went through many editions, translations, and adaptations. In this work the essentials of the story are given as follows:

Faust, weary of the pursuit of learning and worldly pleasures alike, has taken up the study of magic and necromancy. He conjures the devil, who engages to serve him in all he may desire for a period of 24 years, after which he passes into the devil's power. The devil accordingly procures for Faust all sorts of pleasures and supernatural aids to his study of sorcery, alchemy, and philosophy. Faust has occasional fits of repentance, which pass as his servant provides fresh delights; among his lovers is Helen of Troy, a familiar medieval incarnation of pagan delights. When the appointed time expires, Faust dies in an agony of fear, and falls irrevocably into the devil's hands.

The Legend in Literature

The *Tragicall History of Dr. Faustus*, the drama by Christopher Marlowe, published in 1604, is the first appearance of the story in serious literary form in England. It was derived from an English version of the Spiess publication, published probably about 1590. Faust is depicted as a young man, enjoying to the full his ill-gotten pleasures; and the devil, Mephistopheles, is a genuinely tragic figure, fallen from heaven and tortured by regret for his lost state. Helen of Troy is conjured up near the end of the tragedy, symbolising the return of ancient beauty in the Renaissance to challenge medieval doctrines.

The Faust of Goethe, the greatest version of all, is a long verse drama in two parts. Beginning in 1773, Goethe did not complete working on it until 1832, a few days before his death, but parts were published in 1790 and 1808. The story is developed on widely different lines from the early Faust books. Faust, inspired by a fierce desire for knowledge and for pleasure, and convinced of the unreality and uselessness of his life, sells himself to Mephistopheles. He seduces and deserts the beautiful Marguerite, who in despair kills her child and is thrown into prison. Faust visits her, and tries in vain to persuade her to flee with him, but she dies in his arms. A voice from Heaven declares that

penitence has saved the soul which he had imperilled. This is the central episode in the story, but the Prologue in Heaven describes how the temptation of Faust is undertaken by Mephistopheles as a wager with God, who believes that Faust can withstand his seductions.

In Goethe's second part, the philosophic aspect forms the exclusive interest, and the symbolism is often very obscure. Faust comes to the conclusion that neither learning nor bodily pleasures can satisfy his soul, but only a life of useful activity, contributing to the beneficent works of God and Nature. By this decision his soul is saved from perdition. Goethe has thus transformed the old Faust story, with its stress on the punishment awaiting those who seek human and rational knowledge in preference to theological doctrine, into an expression of the noblest humanism in thought and action.

Faust has also been the subject of a romance by Friedrich Klinger, 1791, of a dramatic poem by Nikolaus Lenau, 1836, and used as the basis for operas by Spohr, 1818, Berlioz, 1846, and Gounod, 1859. A tragedy, *Faust*, by W. G. Wills, based on Goethe's version, was produced successfully by Henry Irving at the Lyceum, London, Dec. 19, 1885, revived in 1888, 1894, and 1902. In 1920 the original version of Goethe's *Faust*, found by Friedrich Schmidt in a contemporary manuscript copy, was produced in Berlin by Max Reinhardt. Dorothy L. Sayers's play, *The Devil to Pay*, 1939, also dealt with the legend. *Pron.* Fowst. *See* Goethe; Mephistopheles; *Consult also* Johann Faust, *The Man and the Myth*, H. G. Meek, 1930.

Faustina (d. A.D. 141). Wife of the Roman emperor Antoninus Pius. His daughter of the same name (d. A.D. 175) married Marcus Aurelius, successor of Antoninus. Mother and daughter were noted for their profligacy, yet their memory was held in honour after their death by their husbands, who founded institutions for the educating of orphan girls called after them *Faustianae*.

Faust Up to Date. Burlesque written by George R. Sims and Henry Pettit, with music by Meyer Lutz, produced Oct. 30, 1888, at The Gaiety, London, where it ran for 180 performances.

Fauvism. Art movement. The term *fauve*, wild beast, was applied in derision to a group of expressionist painters who first exhibited in Paris in 1906. Reacting against

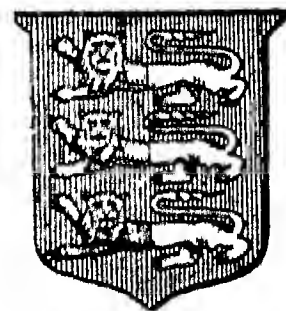
the limitations of neo-Impressionism and all attempts at naturalism in art, the leaders influenced many of the younger painters of the day. Its adherents included Matisse, Braque, Vlaminck, Dufy, Van Dongen, and Friesz. Their work was characterised by broad patterns of decorative colour used in large, unbroken areas chained by heavy outlines. In their revolt against academic influences the Fauvists turned to negro art.

Fauxbourdon. Musical term denoting a system of vocal harmony which in its simplest form consists of a chain of first inversions, beginning and ending with a chord in root position, i.e. bass, fifth, and octave.

Favara. Town of Sicily, in the prov. of Agrigento. It stands at an alt. of 1,100 ft., 5 m. S.E. of Agrigento and 9 m. from the Mediterranean. The centre of a fruit-producing district, it is noted for its sulphur mines; other products are marble and tourmaline. There is a 14th-century castle of the Chiaramonti. Pop. (1951) 25,166.

Favart, CHARLES SIMON (1710-92). French dramatist. Born in Paris, Nov. 13, 1710, he produced his first light opera, *Les Deux Jumelles*, in 1734, with such success that he left his father's bakery business and turned to playwriting. Under his direction the *Opéra Comique* became the centre of this class of work for many years. A *protégé* of Madame de Pompadour, he scored other notable successes with *La Cherceuse d'Esprit*, 1741; *Les Moissonneurs*, 1747; *Les Trois Sultanes*, 1761. His wife, Marie Justine du Roncerai (1727-72), was a celebrated actress, whose coldness to the enamoured Marshal de Saxe, when the Favart company was performing in his camps in Flanders, 1747, brought his wrath on her, and a *lettre de cachet* on her husband, the execution of which he escaped. Favart died in Paris, May 12, 1792.

Faversham. Mun. bor. and market town of Kent, England. It stands on a branch of the Swale, called Faversham Creek, and is 9½ m. N.W. of Canterbury, with a railway station. In 1147 Stephen and Matilda founded here Cluniac abbey of which traces still exist. In it the royal pair and their son Eustace were buried. The cruciform church of S. Mary Charity, in the Early English style.



Faversham arms

restored by Sir G. G. Scott in 1874, contains some superb brasses.

Faversham has a trade in fruit, hops, and agricultural produce, also powder mills, brickworks, breweries, a canning factory, and an oyster industry. The port has a trade in coal, timber, etc. The corporation owns a recreation ground and cemetery. The town gives its name to a co-constituency. Owing to its position where Watling Street touched the river, Faversham was probably an important place in Roman Britain, certainly in Anglo-Saxon

times. It was a member of the Cinque Port of Dover, and was governed as now, by its own mayor and corporation, while its abbot was powerful. Market days, Wed. and Sat. Pop. (1951) 12,294.

Favignana (anc. *Aegusa*). Island of the Mediterranean, belonging to Italy. It lies off the N.W. coast of Sicily, and, covering 8 sq. m., is the largest of the Aegades Islands. Favignana, the chief town and fishing port, lies on the N. shore, and has a fortified harbour. Off the island the Carthaginian fleet was defeated by the Romans in 241 B.C. The island is 6 m. long, and rises over 1,000 ft. It is honeycombed with caves.

Favonius. In Roman mythology, the name of the W. or S.W. wind which blew in spring, identified with the Greek Zephyrus.

Favorinus. Greek sophist and rhetorician. A native of Arelātē (Arles) and a great traveller, he flourished during the reign of Hadrian. He wrote several miscellaneous works, but none survives.

Favre, Jules Claude Gabriel (1809–80). A French statesman. Born at Lyons, March 21, 1809, he entered the legal profession, and, an ardent republican from the first,



Jules Favre,
French statesman



Faversham, Kent. The parish church of S. Mary of Charity, restored in 1874

presidency, 1851; defended his assailant Orsini, 1858; led the republican opposition in the chamber, 1863–70; and founded the republican paper, *L'Électeur*, 1868.

In the government of national defence, 1870, Favre was foreign

minister and vice-president, but mismanaged the armistice negotiations, Jan. 28, 1871, and as foreign minister under Thiers, 1871, was easily out-manoeuvred by Bismarck. The treaty of Frankfurt brought about his resignation, July 23, 1871. He was elected to the senate in 1876, and died Jan. 20, 1880.

Favus (Lat., honeycomb). Disease caused by a parasitic fungus, of the genus *Achorion*, which most frequently attacks the scalp, but may affect any part of the skin. Favus is common in Eastern Europe and Asia, but is rare in Great Britain. On the scalp it first appears as small, irregular cups of a sulphur-yellow colour. Large scabs are gradually formed which eventually drop off, leaving a depressed scar destitute of hair. Favus of the nails somewhat resembles ringworm of the nails. The condition is intractable, and may persist for years. The contagion may be derived from rabbits, dogs, fowls, and other animals. Exposure of the patch to X-rays, followed by vigorous treatment with antiseptics, gives the best results.

Fawcett, Henry (1833–84). A British politician. Born at Salisbury, Aug. 26, 1833, he graduated at Cambridge in 1856, distinguishing himself in mathematics. He was accidentally blinded at a shooting party in 1857, but, taking up his fellowship at Trinity Hall, devoted his time to the study of political economy, of which he became professor in 1863. In 1867 he married Millicent Garrett, a distinguished advocate of women's rights. In 1865 he became Liberal

M.P. for Brighton. Identifying himself with schemes of reform and devoting himself especially to all questions concerning India, he became known as the



Henry Fawcett,
British politician

member for India. In 1875 he was elected M.P. for Hackney, and in 1880 became postmaster-general under Gladstone, but without a seat in the cabinet. He introduced several postal reforms. He died at Cambridge, Nov. 6, 1884. Consult *Life*, L. Stephen, 1885; *A Beacon for the Blind*, W. Holt, 1926.

Fawcett, Dame Millicent Garrett (1847–1929). A British writer and feminist. Born June 11, 1847, at Aldeburgh, she was the sister of Elizabeth Garrett Anderson. In 1867 she married Henry Fawcett (*v.s.*). She became a leading advocate of women's suffrage as president of the national union of women's suffrage societies until 1919. Her two text-books, *Political Economy for Beginners*, 1870, and *Tales in Political Economy*,



Millicent Garrett Fawcett

1875, had great popularity. She wrote *Essays and Lectures*, jointly with Henry Fawcett, 1872; *Life of Queen Victoria*, 1895; *Women's Suffrage*, 1912; *What I Remember*, 1925. Created D.B.E. in 1925, she died Aug. 5, 1929.

Fawcett, Percy Harrison (1867–?). English explorer, born at Torquay, Aug. 31, 1867. He commanded a brigade of artillery in the First Great War. In 1922 he led an expedition into the unexplored heart of Brazil, and two years later made with his son a second journey to the district, being last heard of in 1925. Several expeditions went in search of Fawcett, and although he was generally presumed to be dead, reports were circulated for some years that he was living with the Anafuqua Indians. Consult *Man Hunting in the Jungle*, G. M. Dyott, 1930.

Fawkes, Guy (1570–1606). English conspirator, central figure in the Gunpowder Plot. Born at York, April 16, 1570, he served for some years with the Spanish armies in the Low Countries from 1593

In 1604 a small group of Roman Catholic zealots, finding that they had nothing to hope from the accession of James I, formed a plot for the overthrow of the government by blowing up king, ministers, and parliament together; in the resultant chaos, the Roman Catholics, headed by the conspirators, were themselves to seize the government. The secret, imparted to few—Catesby, Percy, Digby, Rookwood, and Tresham are the most familiar of the names of the plotters—was for a long time well kept. The design was to be carried out on the day of the assembling of parliament in Feb., 1605. But the meeting was adjourned till Oct., and finally till Nov. 5. The conspirators procured an adjoining house which gave them access to the chambers under the Parliament House, where gunpowder was stored, while the carrying out of the plot was entrusted to Fawkes.

Betrayal of the Plot

But at the critical moment a hint was conveyed by one of the conspirators, Francis Tresham, to Lord Monteagle, warning him to absent himself from the ceremony, since "this parliament shall receive a terrible blow, and shall not know who hurts them." The meaning of the hint was unexpectedly elucidated: on the night of Nov. 4 Fawkes was found at his post, and was seized after a desperate resistance. The rest of the conspirators fled, but were hunted down and captured or slain. A full confession was extorted under torture from Fawkes, who, with the surviving conspirators, was executed, Jan. 31, 1606.

The share taken in the affair by the Jesuits is a matter of dispute, but two of them, Gerard and Garnet, the head of the order in England, certainly knew of the plot, though the latter is said to have received his information only under the seal of confession. The effect of the plot was to establish in the minds of the English people an unreasoning and persistent fear and hatred of the R.C.s; though none but a few desperate fanatics had been concerned. The Gunpowder Plot, by H. R. Williamson, 1951, gives a R.C. view of the affair.

Fawley. Village of Hampshire, England, on Southampton Water. Here, during 1949-51, was constructed, at a cost of £37,500,000, a petroleum refinery, at its opening the largest in Europe. It was anticipated that annual production would eventually rise to 6,500,000 tons of petroleum products, and 12,000 tons of sulphur.

Fawn. The young of a deer; strictly a calf, either buck or doe, of the first year.

Fayal OR FAIAL. Island of the Azores, belonging to Portugal. It lies W. of Pico and covers 65 sq. m. Almost wholly mountainous (highest point, 3,300 ft.), it is fertile, cereals, fruit, and vegetables being cultivated. The fig tree flourishes, and from its pith carvings are made; lace is made from the agave. Basket-making is carried on, but the so-called Fayal wine was made in the neighbouring island of Pico. The capital and chief port is Horta.

Fayalite. An orthorhombic mineral, silicate of iron (Fe_2SiO_4). It is one of the end-members of the olivine group, ranging from pure forsterite, Mg_2SiO_4 , to pure fayalite, Fe_2SiO_4 . Fayalite has been suggested as the name to cover members of this series containing 10 p.c. of the forsterite molecule.

Faye, HERVÉ AUGUSTE ÉTIENNE (1814-1902). French astronomer, born at St. Benoît-du-Sault, Indre, Oct. 5, 1814. He was made professor of astronomy at Nancy in 1854, and in 1873 professor of astronomy and geodesy at the École Polytechnique in Paris. He discovered the comet named after him, Nov. 22, 1843. It has a period of $7\frac{1}{2}$ years, and pursues the most nearly circular path of any known object of the kind. His name was associated with the cyclonic theory of sunspots, with the nature of, and velocities in, prominences. He died in Paris, July 4, 1902.

Fayum OR FAIYUM (Coptic, lakeland). Province of Upper Egypt, 40 m. S.W. of Cairo. The province consists of a nearly circular basin, well irrigated and fertile, sunk below the level of the surrounding desert and connected with the Nile by a narrow channel. It is watered by the Bahr Yusuf an old Nile branch. In it are Lake Moeris and the town of Medinet-el-Fayum or Fayum (pop. 74,300). Chief products are rice, cotton, flax, hemp, figs, olives, oranges. Area 690 sq. m. Pop. 672,000.

The province abounds in ancient remains, dating from Neolithic times onwards. Extensive works of land reclamation were carried out by the pharaohs of the XXIIInd dynasty, who made Fayum their capital and were buried in pyramids at Hawara, Lisht, and Illahun, and by the Ptolemys. At Gurob, precious papyri were recovered from mummy-wrappings other papyrus collections have

come from Arsinoë (just to the north of Medinet-el-Fayum) and elsewhere. See Amenemhat; Hawara; Illahun; Ptolemy II.

Fazogli OR FAZOKL. Region of the Anglo-Egyptian Sudan. It is intersected by the Blue Nile and borders Abyssinia on the S. and E. The great majority of the inhabitants are negroes, but there are also a number of Arab settlements. The chief town is Famaka. Gold, ivory, gum, and fruits are exported, and tobacco and durra are produced.

Feale. River of Ireland. Rising in N.W. co. Cork, it passes N.W. between cos. Limerick and Kerry and thence W. through Kerry to the Shannon, which it enters as the Casheen. Its length is 37 m.

Fealty (Lat. *fidelitas*, faith). Feudal vassal's fidelity to his lord. Under the feudal system the oath of fealty was taken by every tenant or vassal and bound him to be faithful to his lord. It corresponded to the oath of allegiance taken by the lord to the king. After the break-up of the feudal system fealty was often commuted for a money payment. It was abolished in 1922.

Fear (A.S. *fær*). An emotion roused by the presence or expectation of danger. In animals it prompts to immobility, flight, or attack; in reasonable men, to conduct which will remove the source of fear. In its extreme form—panic—reason loses control and blind instinct sweeps over all, in which state men will rush into situations of greater danger. Anxiety, a form of fear, is the most important of all emotional forces, far-reaching and devastating. Fear of doing wrong, of disapproval and punishment, human or divine, is the strongest instigator of moral conduct. On the other hand strong fear clouds judgement and produces morbid consciences and irrational feelings of guilt, while fear for personal safety is the cause of many crimes. If prolonged and acute, anxiety may become unbearable and must be repressed. When this occurs it accumulates in the unconscious and gives rise to morbid states that vary between physical illness, a chronic tendency to worry, and neurosis.

Fear is attended by marked physical reactions. Adrenalin is poured into the blood, the action of the heart is quickened, and blood may rush to it with such violence as to cause death; the hair rises; the subject sweats, stares, and pants; sight and hearing become more acute.

Fear. A cape or headland of North Carolina, U.S.A. Extreme S. point of Smith's Island and of the state. It has a lighthouse.

Fearon, PERCY HUTTON (1874-1948). Real name of the British cartoonist Poy (*q.v.*).

Feast. Term applied to days on which notable events in Church history, giving occasion for solemn joy, are commemorated. An Act of Edward VI prescribed certain days only to be kept as feast days, and a list of those now observed appears in the Prayer Book. From this has developed the use of the word for occasions of rejoicing in public or private; for public dinners, *e.g.* mayoral or civic feast, etc. Certain feast days, *e.g.* Michaelmas, are used in connexion with tenancy and other agreements. See Easter.

Feather. Outgrowth of the skin in birds. In the developing bird embryo the skin is thrown into folds which run in certain patterns. These folds become interrupted, but at the points where they persist growth continues and produces series of thimble-like outgrowths (Fig. 1), the pterylae or rows of feathers. The individual outgrowths are the



Feather. 1. Thimble-like outgrowths from which feathers grow

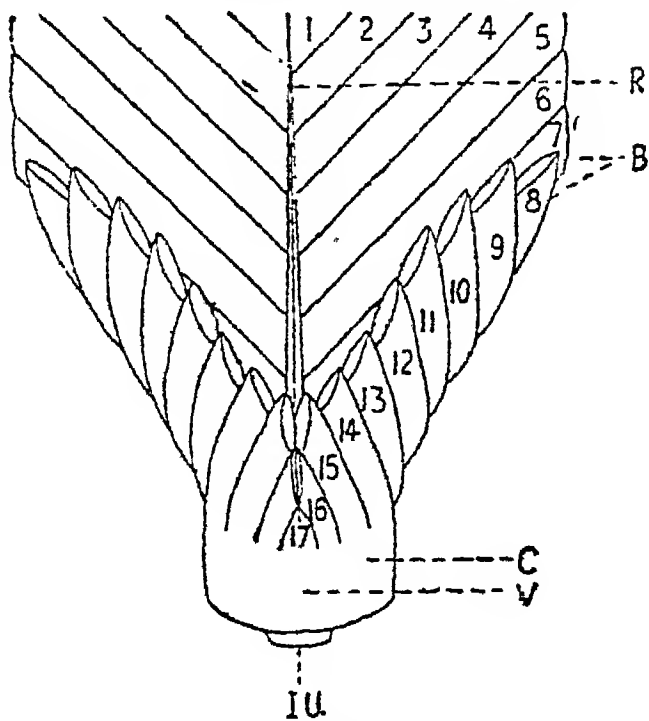
feather-germs. These thimbles of ectoderm placed upon fingers of mesoderm produce the feathers by simple direct growth. Each sinks from the surface and comes to occupy the bottom of a depression called the follicle (Fig. 2). Growth of the bottom of the thimble pushes out a hollow cylinder of ectoderm, the mesodermal core dying away at its tip as growth proceeds. Upon the inner side of this hollow cylinder there develop pleats like those in a kilt. These all begin on the side of the cylinder towards the rear of the bird.

As this side is beneath the anterior side because the feather slopes backward, it is called the



Feather. 2. The bottom of the follicle

ventral side; that opposite is the dorsal side. As growth continues, these pleats do not run straight down the cylinder, but take on a half-spiral form. Each just fails to reach its opposite number on the dorsal side. The strip running down the dorsal

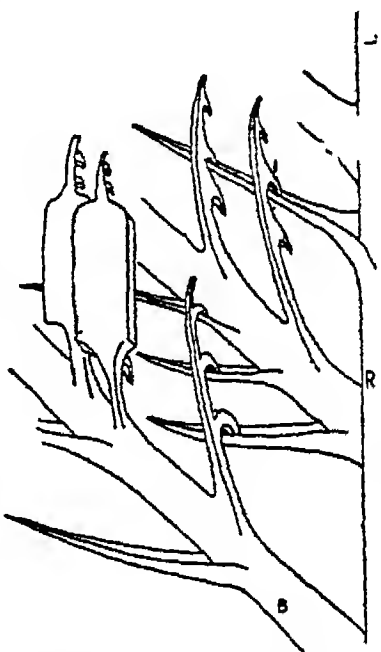


Feather. 3. The definitive feather. B (1-17), barbs of definitive feather vane, serially numbered in order of development; C, collar; IU inferior umbilicus; R, rachis of definitive feather; V, ventral

side where the pleats fail to meet is called the rachis or central rib of the feather. The pleats are called the barbs. All the ectodermal cells concerned in this process become loaded with keratin or horn and die. The cylinder splits down the ventral side and the dead horny structure opens out as the definitive feather (Fig. 3). The barbs are held together by barbules in the form of hooks and troughs indicated in Fig. 4.

In the peacock and some other birds some of the backs of these barbules are iridescent. In most birds which are not white the cells out of which the feather is made become loaded with melanin, a

colouring matter supplied to them in grains by special cells. The production or supply of these grains is in many forms affected by the sexual hormone of the female, though not by that of the male. This accounts for some of the differences in colour between



Feather. 4. The barbs held together by barbules in the form of hooks and troughs. B, barbs; R, rachis

the sexes in birds. If female hormone is given to a brown Leghorn capon the breast feathers growing at that time are coloured in the light female way instead of the dark male way. A small dose gives a short duration of the effect and so a narrow bar of female colour (Fig. 5).



Feathers are also usually coloured by carotene pigments. A few parrots have a yellow pigment that fluoresces in ultra-violet light, so that they look uncannily bright. Plantain-eaters (*q.v.*) have a pigment which, being water-soluble, washes out in heavy rain. Budgerigars exhibit the Tyndall effect having black cores to the barbs which absorb the long wave light while the short wave light is scattered back by the keratin, which has variations of refractive index in it and encloses air of a refractive index different from that of any keratin. The resulting colour is blue or green. White feathers are white as a limiting case of this scattering effect.

Feather. Term used in connexion with the adjusting of an oar, ship's propeller, or airscrew so that it offers the minimum resistance to water or air. In rowing, feathering is done by turning the blade of the oar horizontally as it leaves the water. The blades of a ship's propeller are so feathered or set in the boss that they offer the minimum resistance to the water as the leading edge of the blade moves forward with the revolution of the shaft, but exert the maximum grip in the water; the trailing edge of the blade is set so that the water slips off the blade with the minimum of resistance. On paddle-steamers the float boards of the paddles are feathered by fitting them so that they turn on an axis to present their broad side to the water at their lowest submergence, but turn their edge to the water on entering or emerging.

Airscrews are feathered to overcome the phenomenon that a propeller does not pull an aeroplane along equally well at all heights. If it is most efficient at 1,000 ft., its thrust will be much less at

30,000 ft. The feathering or variable pitch airscrew enables the angles of the blade to be altered in relation to the axis of the propeller boss while the aircraft is in flight and so maintain maximum thrust. A feathering airscrew enables the pilot to get the maximum pull from the airscrew when taking off. In aeronautics, feathering is akin to gear-changing on a motor car, enabling the aircraft to make the best use of its propeller at varying speeds and heights. In certain feathering airscrews the alteration in the pitch of the blades is effected automatically by the engine in conjunction with a governor; in other types a small reversible electric motor is fitted into the propeller boss, the degree of feathering, or pitch variation, being indicated by a dial on the instrument panel. *See* Airscrew.

Feather. River of California, U.S.A. Rising in many headstreams in the Sierra Nevada range, it flows S.W. and S. to the Sacramento river about 15 m. above Sacramento city. Over 230 m. long, it is navigable for 30 m. It was in the "gold rush" area, 1849.

Feather Grass (*Stipa pennata*). Perennial grass of the family Gramineae. A native of Europe, it was long cultivated in gardens as an ornamental plant. The glume containing the seed is covered with stiff hairs pointing upwards, whilst its base terminates in a sharp point. Above it is continued as a long, spirally twisted awn, ending in a long feather-like tail. The wind acting on the glume detaches the seed, etc. from the plant, and when it reaches the earth the spiral, by expanding in dry and contracting in wet weather, forces the seed into the ground, the bristles on the glume allowing it to enter but preventing its return. If these seeds get into the fleece of sheep they are driven by the same mechanism into the flesh of the animal. Two allied species, *S. capillata* (Russia) and *S. spartea* (N. America), are known to kill sheep in this manner.

Feather Star. Class of the Echinodermata (*q.v.*), otherwise known as sea lilies. They resemble very slender starfish, with long rays bearing little branches or pinnules, somewhat like feathers. They live in deep water. Only one species, the rosy feather star, occurs around the British coasts. *See* Crinoidea.

Featherstone. Urban district and parish of the West Riding of Yorkshire. It is 2 m. W. of Pontefract, with a rly. station, and is a

coal mining centre. The place is specially known because, during a strike, there was a riot here, Sept. 7, 1893. Colliery works were destroyed, the military arrived, and order was not restored without bloodshed. Pop. (1951) 13,925.

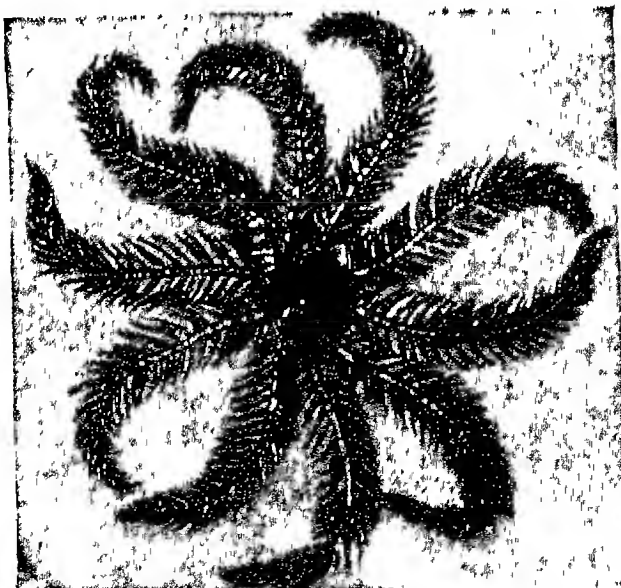
Featherweight. Literally a weight absolutely exact, so much so that the addition of a feather would make it wrong. The term is used in racing for the lightest weight that can be carried by a horse in a handicap race. In boxing it refers to the lightest class but two of competitors in a recognized competition; a featherweight boxer must not exceed 126 lb. in weight. *See* Boxing.

Febrifuge (Lat. *febris*, fever; *fugare*, to put to flight). Term used for any medicine that lessens fever. Antipyrin and phenacetin are febrifuges, as are substances that induce sweating. Fever is now recognized as often a beneficial reaction to invasion of disease, and is allowed to run its course. If it is too high, cool sponging is preferable to drugs.

Febris. In Roman mythology, the personification of fever, also the goddess who was supposed to avert it. Three temples in Rome, one on the Palatine, were sacred to her.

Febronianism. Reform movement among the Roman Catholics of Germany. It was started in 1763 by Johann von Hontheim, who wrote under the name of Justinus Febronius. Its object was to limit the autocratic power of the pope and to secure a larger measure of independence for national churches.

February. Second month of the Christian calendar, ordinarily consisting of 28 days, but in leap year of 29. The name comes from Latin *februare*, to purify, in allusion to the Lupercalia (*q.v.*), the Roman expiatory festival, which, as well as the Feralia, or general festival of the dead, was celebrated in Rome during this month. The month is popularly known as



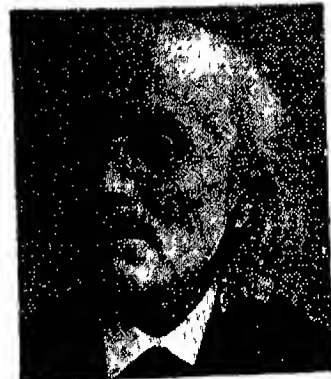
Feather Star. Specimen of rosy feather star, *Antedon bifida*

February "fill-dyke," referring to the melting of the winter snows. January and February were additions to the old Roman calendar. *See* Calendar.

Fécamp. Town and seaport of Normandy, in the dept. of Seine-Maritime, France. It stands on the English Channel, at the mouth of the river Fécamp, 28 m. N.N.E. of Havre. The port, which has a harbour and docks, has a trade in coal, timber, etc.; it is also a fishing centre. There are some industries, mainly shipbuilding, and here is made the liqueur called benedictine. A commercial broadcasting station before the Second Great War attracted British listeners.

The most interesting building is the church of the Trinity, built in the 12th century, once the abbey church. A magnificent building, it has a spacious and noble interior, fine memorials and decorations, tombs, stained glass, etc. S. Étienne is a 16th century church, while the remaining monastic buildings are now used for the town hall, library, and museum. The town grew up around a nunnery founded in the 7th century to hold a relic of the True Blood, which was washed ashore in the trunk of a fig tree. The name may be a corruption of *ficus campus*. Pop. (1954) 18,201.

Fechner, GUSTAV THEODOR (1801-87). German philosopher. Born near Muskau, Prussia, April 19, 1801, he was professor of physics and afterwards of philosophy in the university of Leipzig. The founder of psychophysicism, he held that all mental



Gustave Fechner, German philosopher

changes were accompanied by a parallel change in the nervous system. His chief scientific works are *The Supreme Good*, 1846, and *Elements of Psychophysics*, 1860. Fechner was also the author of satirical writings under the name of Dr. Mises. He died Nov. 18, 1887. *See* Psychophysics.

Fechter, CHARLES ALBERT (1824-79). British actor. He was born in London, Oct. 23, 1824, and was a sculptor before he went on the French stage in 1844. He soon became recognized as the leading French *jeune premier*, notably by his Armand Duval in *Dumas fils' La Dame aux Camélias*, 1852. He appeared at The Princess's, London, Oct. 27, 1860, as Ruy Blas in

a version of Hugo's play, with great success. His Hamlet was enthusiastically received; but his Othello proved disappointing. Lessee of The Lyceum, 1863-67, he played in melodramas, such as The Corsican Brothers. He finally left England in 1872, remaining in America until his death, Aug. 5, 1879. It was Fechter who presented Charles Dickens with the chalet at Gad's Hill in which much of the novelist's last work was done.



John Fechter

Feckenham, JOHN (c. 1515-84). An English ecclesiastic. Born at Feckenham, near Droitwich, he became a Benedictine monk at Evesham, and then was rector of Solihull. He was confined in the Tower by Cranmer, 1549-53. When Mary restored the monastery of S. Peter at Westminster, he was chosen abbot. At the accession of Elizabeth he refused to acquiesce in the reformation of the Church, opposing the new liturgy and the Act of Uniformity, 1559. The monastery was later dissolved and Feckenham lived in confinement at London and Wisbech until his death, Oct. 16, 1584.

Feddan. Modern Egyptian land measure. The feddan is 1.038 acres, but in certain localities it is equivalent to 1.127 acres, whilst formerly it equalled as much as 1.266 acres. The measure is divided into 24 kirats.

Federal Bureau of Investigation. Detective service of the United States department of justice established in 1908 for investigating violations of the law. The F.B.I. is concerned with crime as it affects the U.S.A. as a whole, as distinct from individual state offences which are the responsibility of the local police. It is the authority in enforcing the laws relating to white slave traffic, theft of motor vehicles, blackmail, racketeering, and kidnapping. During the Second Great War the F.B.I. was responsible for counter-espionage, combating sabotage, and coordinating the search for escaped prisoners of war. It maintains forensic laboratories and an identification department with some 100,000,000 fingerprints, normally added to at the rate of 7,000,000 a year. The investigating staff of the bureau are popularly known as G-men (*q.v.*).

Federalism (Lat. *foedus*, a league). Form of government. The federal form of government involves limitations upon the power of the central government of a sovereign state, and fairly large units of subordinate government. Thus a federal state is distinguished from a confederation of states in having a powerful, though limited, central government; and federal units are distinguished from units of local government in being large and controlling elements in the governmental organism.

Federation means either the character of the government in a federal state, or the political movement towards decentralisation; and thus it may be best explained by reference to the practice of federal governments. Such governments may be formed either by the unification of diverse units, as in Switzerland and the original United States of North America, or by decentralisation of a single unit of government, as in Canada. The federal states of South and Central America vaguely reflect both methods of formation.

The subordinate elements in a federation are sometimes called states, as in N. and S. America, and sometimes called by other names, *e.g.* cantons in Switzerland. The idea of subordination, however, is not quite adequate, for the distinction between the functions of central and non-central government in a federal state is not one between a superior and an inferior. The distinction is based on a division between equally important functions.

The non-central governments generally deal with industrial issues of a localised character, with education, with taxation or a large part of it, with roads and summary justice; the central governments deal with peace and war, foreign or international affairs, basic administration of justice, and communication. Clearly the way in which the functions are divided must vary with the peculiar circumstances or the history of the people concerned, and where there is an increase of governmental functions there may be disputes as to the competence in particular issues of the central and the non-central governments.

Bibliography. History of Federal Government, E. A. Freeman, 1863; Federation in Central and Eastern Europe, R. R. Schlesinger, 1946.

Federalists. American political party formed in 1787. When the thirteen British colonies of N. America were recognized as an in-

dependent nation in 1783, the most urgent problem before them was the provision of a common central government which at the same time should not interfere with the autonomy of the several states. The practical result was that politicians were grouped into two parties with an indefinite line of demarcation—the Federalists, who emphasised the necessity for strengthening the authority of the central government, and the anti-Federalists, who emphasised the rights of the individual states. Since the individual interests of the northern states clashed with the individual interests of the southern states, while if representation rested upon population and wealth the north would dominate the central government, the northern politicians became roughly identified with the Federalists, the southern with the anti-Federalists.

Washington, as president, did not wish to identify himself with a party; Hamilton, the leading Federalist, and Jefferson, a prominent anti-Federalist, served under him in the same government. But at bottom the real question was whether the interests of the N. or those of the S. should predominate. The series of presidents from Jefferson onwards were anti-Federalists—mainly a consequence of want of solidarity among the Federalists and of the popular anti-British policy of the anti-Federalist statesmen. The Federalist party broke up and disappeared after the "Hartford Convention," which was held by the Federalist states of New England in 1814, with the somewhat paradoxical aim of organizing defence against encroachments upon the rights of the northern states, while it was strongly suspected of aiming at the separation of the New England states. See United States: History.

Federal Reserve. Banking system of the U.S.A. Each of 12 Federal Reserve banks established in 1913 under control of the F.R. Board acts in the separate district assigned to it as a central bank; thus together the banks maintain the ultimate reserves of the majority of the 15,000 separate banks which serve the U.S.A. and coordinate the operations, within limits, of commercial, state, and national banks. They are bankers also to the government, which appoints members to the central board; issue legal tender notes, which circulate along with those issued by the U.S. treasury; and by means of their lending facilities do much to ensure the stability

of the U.S. banking system, especially in times of crisis. Reserve banks must maintain reserves of 35 p.c. in lawful money against their deposits and 40 p.c. in gold against notes.

Federal Union. Name given to a movement to establish a federation among the democratic countries of the world as a preliminary to a world federation. A society was established in London in 1939 under this name. It was proposed to form a federation of Great Britain, the U.S.A., France, Belgium, the Netherlands, Sweden, Norway, Denmark, Finland, Switzerland, Canada, Australia, South Africa, New Zealand, and Eire. The union was to have a constitution modelled on that of the U.S.A., constituent states retaining a considerable measure of autonomy. Clarence K. Streit, president of Federal Union, Inc., was the principal publicist of the movement.

Federated Malay States. Name formerly given to a federation of native states of Malaya. See Malaya, Federation of.

Federation of British Industries. A British association of manufacturers, founded in 1916 and incorporated by royal Charter in 1923. Its purpose is to formulate and voice considered views on matters of industrial policy; and to assist in day-to-day problems affecting the production and sale of British manufactured goods. The F.B.I. represents some 250 trade associations and 4,500 individual firms, and has district offices in all parts of the Empire and many foreign countries. The headquarters are at 21, Tothill Street, Westminster. S.W.1.

Fee. Payment made for services, especially of a professional kind. The fees of doctors, lawyers, architects, and others are usually settled by custom, although as regards solicitors a maximum scale of fees is fixed by the Law Society. The fees of barristers, being originally honoraria, are not recoverable in a court of law. Fees vary considerably, more especially those of medical men and lawyers. Those of architects, surveyors, and the like are generally arranged on a percentage basis. The charge made for entrance to societies, clubs, etc., also the right to sit at examinations, is called a fee, as is the terminal payment to an educational establishment. See also Fee Simple.

Feed. Mechanical device for automatically conveying materials to a machine, fuel to an engine, or ammunition to a gun. Typical

feeds to a machine are the shuttles used in mechanical weaving, the rollers carrying metal strip to stamping machines such as those used for making coins and buttons, and the paper reels which feed printing presses. Fuel feeds include the pump which conveys petrol from the tank to the carburettor of an internal combustion engine, and the mechanical stoker which conveys solid fuel to a furnace. Ammunition feeds on heavy artillery usually consist of a tray which, lying below and to the rear of the breach, receives the shell and is then mechanically raised so that a hydraulic rammer can push the rounds into the breech. Automatic weapons of the Vickers machine-gun type are fed by a belt which, actuated by the recoil mechanism of the gun, carries the rounds into the breech. Guns of the Bren and Sten type are fed from fixed magazines, a spring in the base of the magazine feeding the rounds into the breech.

Feeder. Conductor which carries an electric current from one point to another; from generating station to sub-station, or sub-station to distribution centre or consumer; usually without intermediate connexions, in which it differs from a distributor cable which has service connexions tapped off.

Feeding Stuffs. Foods for farm livestock. They can conveniently be classed as: *coarse fodders*, which include hay, straw, and chaff, all bulky materials characterised by a high proportion of indigestible fibre; *green fodders*, e.g. grass, lucerne, sainfoin, clovers, vetches, marrow-stem kale, green maize, rape, and mustard; *succulent foods* including turnips, swedes, mangolds, and potatoes, which contain a high proportion of water and a low amount of fibre—dry matter in the succulent foods varies from about 25 p.c. in sugar beet to 9 p.c. in some turnips, almost two-thirds of it in the form of readily digestible sugar; *concentrated foods*, so called because they contain a high feeding value in a much smaller bulk than in the previous classes of foods. A series of *special feeding stuffs*, yeast, dried blood, meat meal, etc., is used for feeding swine.

The manner in which feeding stuffs of all description are utilised in practice is determined by their chemical composition, their digestibility, and the peculiar requirements of the animal to which they are fed. Thus, apart from the maintenance of the heat and

functions of the different organs of the body and the repair of tissues thereby involved—a requirement common to all animals—the use of every food is based on its value for beef production, milk production, the fattening of sheep, lambs, and swine, and the extent to which it supplies vitamins and, finally, mineral ash.

Coarse fodders may be regarded as sources of maintenance requirements; they also furnish the bulkiness without which the stomach is not sufficiently distended to promote the easy flow of gastric juices. Green fodders supply a readily digested proportion of carbohydrate matter and water in a form especially valuable to milch cows. Concentrated foods individually supply the three essential food constituents, protein, fat, and carbohydrates, in a relatively small bulk. Linseed cake and cotton cake contain each about 10 p.c. oil and respectively 30 and 40 p.c. protein. Leguminous seeds which, unlike the two cakes just mentioned, are used without previous processing for the extraction of oil, all possess a fairly high protein content but are low in oil and high in carbohydrates. Soya bean is an exceptional seed, rich in both protein and oil, the figures of which are 33 and 18 p.c. respectively. Of the cereals, wheat and barley contain approximately half as much protein as is found in peas and beans; they are low in oil but rich in carbohydrates. Oats (unhusked) contain as much protein as wheat and barley but much more oil and less carbohydrates. Despite the high proportion of fibre in oats, they constitute one of the best balanced foods for all classes of livestock. Maize contains more oil than wheat or barley and about the same amount of protein, but is distinctly low in ash.

LAWS OF SALE. Under the Fertilisers and Feeding Stuffs Act, 1926, and regulations made thereunder, every person who sells as a fertiliser for the soil or as food for cattle or poultry any of the articles set out in the Act must supply the purchaser with a statement in writing containing the name under which the article is being sold, particulars as to its nature, substance, and quality and (for feeding stuffs) whether it contains certain specified ingredients. In certain cases this does not apply to sales in quantities of 56 lb. or less. The seller warrants that the particulars in the written statement are correct and when

certain feeding stuffs are sold for use as food for cattle or poultry further warrants that the stuff is suitable for that purpose. If either of these warranties is broken the seller may be sued for damages.

Feeling (A.S. *felan*, to feel). Term used in various senses in psychology; especially for that aspect of the mind which includes pain and pleasure, tension and relaxation, and the emotions. In this sense feeling is contrasted with knowing (cognition) and desiring, willing, and striving (conation). To distinguish feelings from sensations, they are usually described in psychology by the term affects.

All animals possess a tendency to seek pleasure and avoid pain, to relieve tension, and to feel elated by success and depressed or angered by failure. The primitive effects are, therefore, held to be exhilaration, ease, distress, anger, and depression. As mental life develops a great variety of emotions appear. The chief function of affective states is to modify the response of the organism to stimuli from the outer world or the bodily organs; e.g. disgust affects appetite. The chances of survival both of individuals and groups are directly related to the degree to which affects are adjusted to external reality and encourage suitable behaviour. Inappropriate, exaggerated, or deficient affects are a marked feature in mental disease.

Fee Simple (Lat. *feodum simplex*). Highest estate known to English law. A tenant in fee simple is what is popularly styled a freeholder. Though in theory the sovereign is the lord paramount, the freeholder can grant his land away or devise it to whomsoever he likes by will. It is presumed that any grant of land is of the fee simple. See Land Laws.

Fee Tail (Lat. *feodum talliatum*, limited). Form of freehold estate set up originally by the Statute De Donis, 1285, by which a grant to X and the heirs of his body gave X an estate tail. This estate would last only as long as X had heirs of his body, and would then revert to the grantor. This led to Fines and Recoveries, tortuous legal fictions by which the estate became fee simple. In 1833 a new Act was passed by which, by a deed enrolled, X could convert his holding into a fee simple. In 1926 a fee tail became an equitable interest. See Entail.

Fehling's Solution. Alkaline solution of copper used for the detection of sugars. Solution No. 1

is prepared by dissolving 34.65 grams of pure copper sulphate in distilled water and diluting to 500 c.c. Solution No. 2 is made by dissolving 50 grams of sodium hydroxide containing not less than 97 p.c. of the salt, and 175 grams of recrystallised Rochelle salt in about 400 c.c. of water, and afterwards diluting to 500 c.c. When required for use equal volumes are mixed together.

Fehmarn OR FEMARN. Island in the Baltic Sea, part of Germany. In area 71 sq. m., it lies off the E. coast of Holstein, from which it is separated by the narrow Sound of Fehmarn and from the Danish island of Maribo on the N. by the Fehmarn Belt. The surface is level and the soil fairly fertile. Its few harbours accommodate vessels of shallow draught. Agriculture, fishing, and the rearing of cattle and sheep are the main occupations. The only manufacture of importance is hosiery. The capital is Burg. Prussia annexed the island in 1866 as a result of her victories over Denmark and Austria.

Fehmarn Belt. Channel between the Baltic islands of Fehmarn and Maribo. It has a width of about 12 m., and leads from the Baltic to Kiel Bay. Fehmarn Sound is a narrow passage between the island of Fehmarn and the mainland.

Fehmgericht (Ger. *Veme*, punishment; *Gericht*, judgement). A medieval German tribunal. Known sometimes as the Holy Vehme, it exercised power, especially in Westphalia, in the 14th and 15th centuries, and is believed to have been a survival from the jurisdictions of the Saxons. The courts were open for trial of civil matters, but might be secret in special cases. It has been estimated that, in the 14th century, the members (*Schöffen* or *Freischöffen*), bound by an all-embracing oath of fidelity, numbered about 100,000.

The government of the tribunal was vested in the king's deputy, the *Stuhlherr*, before whom all members were liable to account for their acts. It had affinity with the process of summary jurisdiction in Anglo-Saxon England, those found guilty of capital offences being hanged, a dagger bearing the secret letters S.S.G.G. being placed on the corpse. As civilization progressed its power waned, to some extent through abuse. The Fehmgericht existed as a sort of minor police court until suppressed by Jerome Bona-

parte in 1811. It was revived in a spurious form by the illegal Free Corps in 1919. Consult Introduction, Anne of Geierstein, W. Scott, 1831.

Fehrbellin. A town of East Germany. It lies 40 miles north-west of Berlin, and is famous for the great victory gained by the Prussians, then the Brandenburgers, under the Great Elector, over the Swedes, June 18, 1675. A monument marks the site of the battle, which the Prussians regard as a memorable one. It was the beginning of Prussia's military power, as till then the Swedes had been considered all but invincible.

Feilding. Town in the North Island of New Zealand. The distributing centre for a large tract of country, it is well laid out around a fine square, and is situated 99 m. N.E. from Wellington by rly. There are dairy factories in the neighbourhood, and the livestock sales are the largest in the North Island. There are also sash and door factories, freezing works, and flour mills. Feilding was a settlement opened in 1874 by an English company represented by Colonel Feilding, and presided over by the 8th duke of Manchester. Pop. (1951) 5,810.

Feilding, ROBERT (c. 1651-1712). English rake, called Beau Feilding. A member of the Denbigh family, he led a regiment in Ireland for James II. After squandering the fortune of his first wife, a daughter of the 1st viscount Carlingford, he married a daughter of the 1st marquis of Clanricarde. After her death he married, in 1705, Mary Wadsworth, represented to him as a wealthy widow, and in the same year also married the duchess of Cleveland, Charles II's former mistress. In 1706 he was convicted of bigamy. Feilding was satirised by Steele and Swift. He died May 12, 1712.

Feiling, KEITH GRAHAME (b. 1884). A British historian. Born Sept. 7, 1884, he was educated at Marlborough and Balliol College, Oxford, received a fellowship at All Souls, and after experience as a lecturer and tutor, including two years at Toronto, 1907-09, was appointed Chichele professor of modern history at his own university in 1946. Feiling specialised in the politics of the 17th century, and also constituted himself the historian of the Conservative tradition in English history. He wrote *History of the Tory Party* (1640-1714), 1924; *What is Conservatism?* 1931; *The Second*

Tory Party (1714-1832), 1938; and the official Life of Neville Chamberlain, 1946.

Feira de Santa Anna. Town of Brazil, in the state of Bahia. It is about 30 m. N. of Cachoeira, on the Bahia-S. Francisco rly. The centre of a region rich in minerals, it produces marble, gold, and diamonds. There is trade in cereals, tobacco, and cotton. Cattle fairs are held.

Feis. Irish word for an assembly. Something like the folk moots of the Anglo-Saxons, these were mainly meetings for the promulgation of laws by the kings, but they had also a festive element. They were frequently held in Ireland, some being national and others local. The most noted was the feis held regularly at Tara for several centuries until 560. Over it the supreme king presided. The word is still in use; for instance, in 1897 a *feis ceoil* was founded to encourage Irish music.

Feisal I (1883-1933). King of Iraq. The third surviving son of Hussein, king of the Hejaz, he



Feisal I,
King of Iraq
Russell

was born at Rahab, Arabia, May 20, 1883, but left it when six years old. He spent 18 years in Constantinople (Istanbul), where he received appointments under the

Turkish government. Along with his brothers, Ali and Abdulla, he took a leading part in the movement which led to the deposition of Abdul Hamid. He commanded the Arab contingent in the Turkish campaigns in the district S. of Mecca, against a new religious sect which was threatening the stability of the emirate of the Hejaz.

When, in June, 1916, his father sided with the Allies against Turkey in the First Great War, the ameer Feisal commanded the rebels in Medina, but was defeated by the Turks. He then presented to the British a scheme for the formation of an Arab regular army. In conjunction with T. E. Lawrence he advanced in 1917 to Akaba on the border of Syria, and Feisal's army eventually formed Allenby's right wing in Palestine. On Oct. 3, 1918, he led his troops into Damascus. His services in the conquest of Palestine and Syria were rewarded with the privilege of setting up in Amman, Damascus, and Aleppo a

provisional military administration which was guaranteed to the Arabs as an independent sphere by the Sykes-Picot treaty.

Acclaimed king, and for a while *de facto* ruler, of Syria, Feisal represented his father, now ruling over Hejaz, at the peace conference, but was unable to prevent the French demand for a mandate over and occupation of Syria. Again proclaimed king by the

extremists, he was expelled by the French in 1920. Next year he undertook the kingship of Iraq, under the aegis of Great Britain, inaugurating his reign on Aug. 23 after a plebiscite. Feisal settled the country on a firm basis, established good relations with Persia and Turkey, checked the unruly Na-

tionalist element and the Wahabis on the frontier, and secured the acceptance by all parties in 1927 of the Anglo-Iraq treaty, by which his adopted country was to join the League of Nations. Iraq became independent in 1932, but the last year of Feisal's reign was marred by the Assyrian rebellion while he was on a state visit to London. He died Sept. 8, 1933, and was succeeded by his son Ghazi. Though sometimes accused of tortuous diplomacy, Feisal steered his kingdom safely through difficult times. A Life by Mrs. S. Erskine appeared in 1933. See Arabia; Lawrence, T. E.; Palestine, Conquest of.

Feisal II (b. 1935). King of Iraq. Born May 2, 1935, he succeeded to the throne on April 4, 1939, on the death of his father, King Ghazi, in a motor accident. Until the king came of age, May 2, 1953, and ascended the throne, Iraq was placed under the regency of his uncle, the ameer Abdul Illah. During the German-inspired Iraqi revolt in April, 1941, the young king had to leave Bagdad, but when the British authorities restored order in June, he and the regent entered the capital in state. He went to school in England, 1947, entering Harrow 1949.

Felanitz or FELANICHE. Town of Spain, in the island of Majorca. It stands in a mt. valley, 28 m. S.E. of Palma, and 7 m. from its port, Puerto Colon. On the mt. of Puig de San Salvador, in the

vicinity, is a Moorish castle with underground vaults. The church of San Miguel is a fine building. Brandy is distilled and soap manufactured. There is trade in cattle, wine, fruit, and earthenware, the water coolers of Felanitz having been noted from the 3rd century B.C. Pop. (1950) 11,771.

Feldspar. One of the most important groups of rock-forming minerals, consisting essentially of



Feldspar. Huge masses of orthoclase, weighing many tons, at Carne, near Veryan, Cornwall

alumino-silicates of the alkalis. They may be grouped into two main groups, the plagioclase feldspars and the potash feldspars. The plagioclase feldspars form a continuous series, the two end-members being albite (soda-feldspar) and anorthite (lime-feldspar); all mixtures of the two occur and the intermediate minerals are called oligoclase, andesine, labradorite, and bytownite. The soda-rich end of the series is characteristic of acid rocks and lime-bearing varieties of basic rocks. The plagioclase feldspars crystallise in the triclinic system.

The potash feldspars include sanidine, orthoclase, microcline, and adularia. All have the same composition and are monoclinic, with the exception of microcline, which is triclinic. Intergrowths between orthoclase or microcline and soda-rich plagioclase feldspars are known as perthites.

Potash and soda feldspar is used in ceramics for pottery, glazes, etc.; in glass manufacture; abrasives; roofing materials; and false teeth; some stones (Amazon stone, sunstone, and moonstone) are prized as gems. All the commercial deposits occur in pegmatite dykes, mainly associated with granitic rocks. For details of the various types, see Microcline; Moonstone; Orthoclase, etc. See also Crystallography illus.

Felidae (Lat. *felis*, cat). Family of the carnivora, or flesh-eating mammals, which includes the cat-like animals. They comprise only

two genera, but a large number of species, and are regarded as the typical carnivores, being the best adapted for catching and preying upon living animals, and, with the exception of the weasels, the most lithe and active of the order.

They are provided with finely developed canine and carnassial teeth and their sharp claws are retractile. One marked feature of the family is the short and rounded muzzle, which is in conspicuous contrast with the long and sharp muzzle in the dogs. Their fur is soft and often handsomely marked, and their feet are provided with cushion-like pads which enable them to move about silently. All are of savage disposition, and only two species have been domesticated with any success. See Cat.

Felix (d. c. 647). English saint and bishop. A native of Burgundy, he came to England, and, helped by Sigebert, king of E. Anglia, preached Christianity. Felix became bishop of Dunwich, and is said to have founded the monastery at Soham. His name survives in Felixstowe, Suffolk. His festival is kept on March 8.

Felix. Name of four popes and five anti-popes, of whom the following are notable. Felix I (d. 274) is entered in the Roman martyrology probably in mistake for a Roman martyr of the same name buried on the Via Aurelia. A letter of the pope's in response to a report by the synod of Antioch, which had deposed its heretical bishop, Paul of Samosata, was made use of at the council of Ephesus (431). To Felix I, who reigned 269-74, was attributed a decree for the celebration of masses over the tombs of the martyrs. His festival is kept May 30.

Felix II, pope 355-58, was a Roman archdeacon intruded into the papal chair on the banishment of Liberius by the emperor Constantius. On the return of Liberius, Felix was exiled and lived in retirement until his death, Nov. 22, 365. Felix III, pope 483-92, was chiefly engaged in conflicts with heretical bishops at Alexandria and Antioch. Felix IV, pope 526-30, was the nominee of Theodoric the Goth. He obtained an edict from Theodoric's successor ordering all charges against the clergy to be taken to ecclesiastical courts.

Felix V, anti-pope, was born at Chambéry, Dec. 4, 1383. He reigned as duke Amadeus VIII of Savoy 1416-34, when he retired



Felixstowe. The foreshore of this holiday resort popular Suffolk

in favour of his son. In 1439 the remnant of the council of Basel elected him as pope, although he was not in orders, in place of pope Eugenius IV, whom they declared deposed. As Felix V he was crowned in July, 1440. He never obtained general recognition, but with some following in Switzerland and Savoy he held his position till 1449, when he abdicated. He died at Geneva, Jan. 7, 1451, last of the anti-popes.

Felix Antonius. Brother of the freedman Pallas, minister of the Roman emperor Claudius. He was procurator of Judaea, but was recalled in A.D. 62 to answer charges of oppression made against him by the Jews. It was before Felix that S. Paul preached at Jerusalem (Acts 23, 24).

Felix Holt the Radical. A novel by George Eliot, first published in 1866. It presents in broad effect the life of a midland county during the 1832 Reform period, but there is something unreal about the central figure, who is too philosophical and cold-blooded to represent the enthusiastic reformer of that time.

Felixstowe. Holiday resort and urb. dist. of Suffolk, England, standing on a cliff facing S. between the rivers Deben and Orwell, 11 m. S.E. of Ipswich. Its beautiful cliff gardens and sea front, two band pavilions, bathing facilities, tennis courts and other sports, and drama festivals in June and Oct. are among its attractions. Felixstowe is a good centre for the Constable country and the Suffolk churches. When the Orwell broke its banks during the tidal floods of Jan. 31-Feb. 1, 1953, 41 people lost their lives here. The town derives its



Felixstowe arms

name from that of the 7th-century bishop S. Felix. Pop. (1951) 15,081.

Fell, JOHN (1625-86). English pedagogue and divine. Born June 23, 1625, he was educated at Christ Church, Oxford, of which he became dean in 1660. Vice-chancellor of the university 1666-69, he was appointed bish-

op of Oxford in 1675. He notably improved the buildings as well as the discipline of his college, and gave material encouragement to the University Press, but is chiefly remembered by some lines,

I do not love thee, Dr. Fell.
The reason why I cannot tell;
But this alone I know full well,
I do not love thee, Dr. Fell.

—attributed to Thomas Brown from lines by Martial. Fell published a critical edition of Cyprian. 1682. He died July 10, 1686.

Fellah (plur. Fellahin). Arabic word for peasant or ploughman, especially in Egypt. Forming the



Fellah. Egyptian sakka or water-carrier

bulk of the native population, the fellahin descend in direct lineage from the ancient Egyptians. They dwell in villages, mainly of mud hovels, under a village chief, the sheikh-el-beled. A wooden statuette, now at Cairo, of a IV dynasty official, found by Mariette at Sakkara, was given that title by the workmen from its likeness to their own headman. Some fellahin are Christian Copts; millions of others adhere to Mahomedanism.

Of medium height, black-eyed, thick-lipped, and straight-nosed, the Semitic and Nubian elements they have absorbed have but slightly affected their racial make-up as a Caucasian people of the Mediterranean type. The progressive deepening of hue from N. to S. marks the influence both of climate and of ethnic contact. The women, who wear head-veils, which expose the antimony-stained eyelashes and tattooed chin, are sometimes wed by the nomad Beduins, but the amount of racial mixture in actual progress is inconsiderable.

Their food is largely vegetable, and they are mostly abstemious. Many of their methods of cereal and pulse cultivation, and of irrigation with water-wheel, sakiya, and balanced bucket, shaduf, are of remote antiquity. The water-carrier, sakka, is often a member of a dervish sect, whose ritual demonstration, zikr, is the occasion of much festivity, wherein quarter-staff, nabut, is a favourite game. The veneration of trees and stones, and the universal employment of amulets, mark the persistence of the predynastic animism of the Nile valley. Those peasants of Palestine also called fellahin are descended from the primitive Canaanite stock. Except for a few colonies introduced under Mehemet Ali they have no ethnic identity with the fellahin of Egypt.

Fellmonger. Dealer in the pelts of slaughtered sheep, one who separates the wool from the hides. The skins may be soaked in lime-water until the roots of the fibre are loosened sufficiently to come away with ease, a method which gives the so-called slipped wool. Alternately the skins may be hung in moist air until bacterial action has loosened the fleece, and this is the method adopted in Mazamet, France, the chief centre of fellmongering. Chemical means may be substituted, the flesh side of the hide being painted overnight with a solution of sodium sulphide. See Leather.

Fellow. Word meaning a male person. It is now used in two senses. In general speech, rarely in a slighting sense, it means a man, and academically it refers to certain members of colleges at Oxford, Cambridge, or elsewhere, and to members of learned societies. The original meaning was that of a companion, hence the phrase fellow-countryman, and this survives in its use at the universities, where it is the equivalent of the Latin *socius*.

In the colleges of Oxford and Cambridge a fellow is a member of the governing body and foundation, and a fellowship is a coveted distinction bestowed on scholars of exceptional ability. Before the reforms of 1877-81 fellows were usually chosen for life, or until marriage. Today they are chosen by the existing fellows, usually for a definite term of years. They may be elected on a reputation or after examination, or because suitable for a particular vacancy on the teaching or managing staff. Many of them act as tutors, and form the group that with the head is responsible for the work of the college.

The fellows of Eton and Winchester form the governing body. The fellows of Trinity College, Dublin, who are divided into senior and junior fellows, are elected after examination, and hold the position for life. King's College, London, and some other colleges, have fellows, but they have a status different from those at the older universities. Following this use, fellow is used for a member of a learned society.

Felo de se (late Lat. *felo*, evil doer, i.e. slayer; *de se*, of himself). English legal term, meaning a man who commits a "felony against himself"—in other words, a suicide. A suicide used to be buried, as Thomas Hood puts it, "at four cross roads, with a stake in his inside." This ended in 1823, and the body of a suicide was ordered to be buried in the usual burial-ground without divine service, between 9 p.m. and midnight. In 1882 the night burial was abolished and a religious service permitted; but the burial service of the Church is not allowed by the rubrics to be used. See Suicide.

Felony. Class of crime in English law. By common law all crimes are either felonies or misdemeanours. Nobody knows for certain the original distinction between them; one theory is that a felony was originally a crime involving a breach of the king's peace. Certainly until 1870 the lands and goods of a felon were forfeited to the crown.

It is a crime to conceal a felony—misprision of felony—but not to conceal a misdemeanour. When a felony has been committed a private person may arrest without a warrant anyone he reasonably suspects of having committed it. A constable may arrest without a warrant a person he reasonably suspects of having committed a felony even if it transpires that none has been committed. With

some few exceptions no such powers of arrest exist for a suspected misdemeanour (*q.v.*).

Felsite. Close-grained or compact rock of varying colour. It consists of altered lava which has lost its glassy structure. Small crystals of feldspar and quartz are scattered through the ground-mass of the rock.

Felspar. Variant spelling of name of a group of rock-forming minerals, described in this Encyclopedia as feldspar.

Felsted School. English public school. It was founded in 1564 by Richard, Lord Riche, and is now governed by a scheme dating from 1876. It consists of six senior houses of fifty boys each, and a junior house of eighty boys. The grounds are 55 acres in extent. There are at least nine entrance scholarships each year. The village of Felsted, sometimes spelt Felstead, is 3 m. S.E. of Dunmow, Essex. Pop. 1,845.

Felt. Kind of cloth which properly consists of fibre aggregates, compacted by heat, rubbing, and moisture, and is not woven. (Needlefelts consist of fibres consolidated on to a central coarse hessian cloth.) The pressed felt industry uses wool as its raw material, with rabbit and other animal hairs in some hat felts. The fibres are scoured and well blended, then passed through a carding process to produce a web. These webs are superimposed to form "batts" 40 yds. long, between $\frac{1}{4}$ in. and 1 in. thick, and 36-80 ins. wide. These are again superimposed to give a thickness of between 6 ins. and 3 ft.

The hardening process follows, the fibre mass being compressed between two metal plattens, with a pressure of 5 to 10 lb. per sq. in. Steam is blown in through perforations in the lower platten, and the upper platten has an oscillating movement. By this means a batt 3 ft. thick becomes reduced to 4 ins. The partly-felted batt is then fulled, i.e. soaked in soap solution (for felt hats) or dilute sulphuric acid (for mechanical pressed felts) and subjected to blows from heavy wooden hammers. Five minutes' treatment suffices for light felts, but 12 hrs. or more is required for thick mechanical felts. Shrinkage of 25-75 p.c. occurs in all directions during fulling. The resulting felt is scoured, dried, pressed, and loose hairs are sheared off. The complete process takes 7-10 days.

Needlefelts are used for carpet underlays and packaging of a variety of materials. Roofing felts are

impregnated with bitumen and other substances to make them impervious to water. Knitted felts, *i.e.* knitted wool fabric subjected to a fulling process till it resembles felt externally, have been used for hats, etc.

Feltham. Urb. dist. of Middlesex, England, 12 m. W.S.W. of London. Much of it is residential, but it has also a number of factories making *e.g.* plastics and sparking plugs, and an important marshalling yard of British Rlys. (Southern Region). The second oldest Borstal institution in the U.K. is at Feltham, where the central ordnance depot was located during the First Great War. Part of London Airport lies within the district. Pop. (1951) 44,861.

Feltmakers' Company. London city livery company. Originally an offshoot of the Mercers,



Feltmakers' Company arms

and later (in 1501) of the Haberdashers, it was granted a separate charter by James I in 1604. An Act of Parliament had been passed in 1566 instituting a seven-year apprenticeship for all journeymen feltmakers, of whom there were 7,000 in London at the time of the charter. The authorised livery is now 350. The offices are at Arundel House, Arundel Street, W.C.2.

Felton, JOHN (c. 1595–1628). English assassin. He came of a good Suffolk family, early entered the army, and served as lieutenant at Cadiz in 1625. Failing to obtain a captain's commission, he applied personally to the duke of Buckingham, who refused his request. Poverty and his animosity against Buckingham, increased by brooding over the attacks on the king's favourite, turned his thoughts to assassination, and he mortally stabbed the duke at Portsmouth, Aug. 23, 1628. He was hanged at Tyburn, Nov. 28 of the same year.

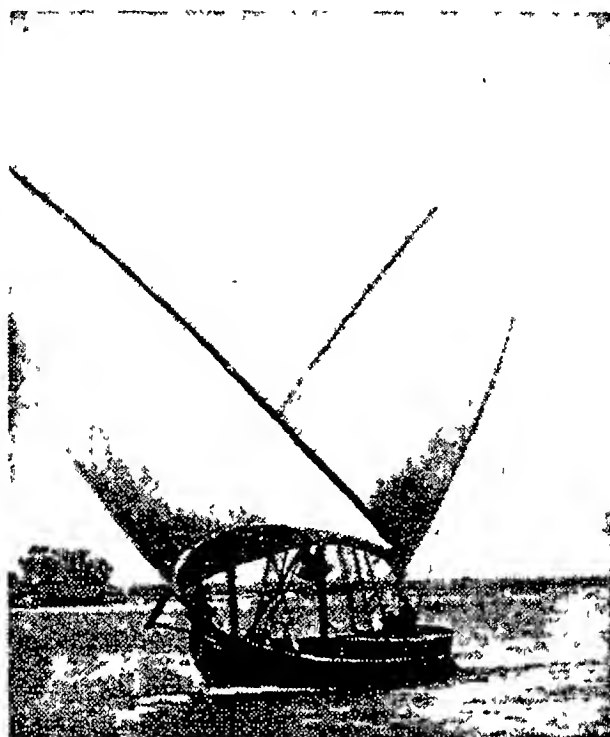


John Felton, English assassin
From an old engraving

Feltre (anc. *Feltria*). City of Italy, in the prov. of Belluno. A picturesque place, standing on an eminence near the Piave river, 885 ft. above sea level, it is 34 m. by rly. N.W. of Treviso. It has a ruined castle, a cathedral, a mod-

ern palace, and a municipal pawnshop, said to be the oldest establishment of the kind in Europe. Minor buildings include a hospital, gymnasium, seminary, and an asylum for orphans. In 1819 the bishopric was incorporated with that of Belluno. There is trade in wine, oil, silk. Pop. (1951) 18,768.

Felucca (Arab. *fuluka*; Ital. *feluca*). Vessel used in the Levant



Felucca. Egyptian sailing boat on the Nile above Cairo

and on the Nile. It is propelled by lateen sails and oars, and moves swiftly. Sometimes the helm can be used at either end of the hull.

Felup OR **FULUP**. Collective name applied by Portuguese traders to numerous primitive negro tribes in the coast-lands of French Senegal and Portuguese Guinea. Under the Mandingan name Jola they extend into British Gambia. Their allied semi-Bantu dialects prevail from the Gambia and Casamance to the Cacheo and Geba rivers. The typical Felup are muscular, flat-nosed, thick-lipped, dark-bronze-coloured hunters, almost unclad, using bow and arrow and inhabiting roughly constructed log-huts or earth-houses.

Feme OR **FEMME**. Anglo-Norman legal term for a woman. A woman who is married is called feme covert, and a woman who is either a spinster, a widow, or divorced, is feme sole.

Femina Vie Heureuse. The name of this literary award has been changed to Stock Prize (*q.v.*).

Feminism (Lat. *femina*, a woman). Term originally used to signify the qualities of females, used in 1895 and later to mean the advocacy of the claims and rights of women. Feminism in the second and more usual sense is a century older than the use of the word to describe it, finding its first clear expression in Mary Wollstonecraft's *A Vindication of*

the Rights of Woman (1792). "She set great value on a mutual affection between persons of an opposite sex," wrote her husband, William Godwin, in his memoir of her; "she regarded it as the principal solace of human life." But she also thought that nothing should keep a man and wife together once mutual love and respect had gone. She advocated that women should be educated in an "orderly manner" to fit them to engage in business—"women would not then marry for a support"; that they should become doctors and nurses, and in particular midwives; that they should have "a civil existence in the state, married or single"; that they should not be "arbitrarily governed without having any direct share in the deliberations of government."

In the world into which she projected these ideas, the education of men was indifferent, and of women non-existent; no women and few men had any political rights; married women had no legal existence as individuals, could possess nothing, had no rights in the custody of their children. Both women and men for the most part greeted Mary Wollstonecraft's ideas with ridicule; but some fifty years after her death they began to produce effects, thanks to the help and encouragement given to women by men like F. D. Maurice, John Stuart Mill, Canon Butler, Arthur Hugh Clough, Sidney Herbert, and Newson Garrett.

Talfourd's Act

Thomas Noon Talfourd, Whig member of parliament for Reading, and a serjeant-at-law, was responsible for the first step taken in the legal recognition of women's rights as human-beings. Led through disgust at his own success in depriving mothers of access to their children in the course of his legal practice, he secured the passage of an act in 1839 which gave a separated wife custody of her children till the age of seven, and access to them afterwards, provided she could prove she was guiltless of adultery. Maurice promoted the foundation of Queen's College, a school opened in 1848 for the training of governesses—the first school for women that had any claim to a standard of learning.

The first society for female suffrage was formed at Sheffield in 1857, and J. S. Mill brought the subject to general notice by putting female suffrage prominently in his election address in

1865 when he stood (and was returned) for Westminster. The National Society for Women's Suffrage was founded two years later, and in the same year Mill presented the first petition for women's suffrage to Parliament; thereafter petitions were persistently presented and bills brought in, by Mill and others.

Until 1857, divorce was possible only by private act of parliament in each individual case, and only the husband could initiate a divorce bill. In that year an act, promoted by the Attorney-General Sir Richard Bethell (afterwards Lord Westbury), gave both spouses the right to divorce, to the husband for adultery by his wife, to the wife for adultery plus cruelty or desertion by her husband; the same act also gave the wife for the first time legal control of any earnings or inheritance she might acquire after separation. Not until 1870 was the first Married Women's Property Act (*q.v.*) passed: this bill was introduced into the house of commons by Russell Gurney, Q.C., who, with his wife, was also a consistent worker for the advancement of women's education. From these beginnings, increasing rights and responsibilities were demanded in Great Britain for women by both women and men feminists, and steadily devolved upon them. (*See Women's Suffrage.*)

Slow Progress on the Continent

Feminism, spreading steadily round the world wherever Protestantism and the Anglo-Saxon way of life held sway, was slow in starting on the continent of Europe. The teaching of Roman Catholicism on marriage hindered its birth in R.C. countries; the Code Napoléon, by giving the wife an inescapable claim on her husband's estate, removed in the countries where it (or its derivative systems) ran one of the bases of feminism in Great Britain.

In tsarist Russia, men and women revolutionaries worked on an equality, and when the revolution came in 1917 equality of status and opportunity was extended to women. Under the Weimar constitution women were given equal political status with men in Germany. In the United Nations Charter the United Nations reaffirmed their "faith in the equal rights of men and women"; and at the end of the Second Great War, women were admitted to the franchise in a number of countries where there had been little or no feminist movement before it (*e.g.*

France, Italy, Hungary). But a movement in the reverse direction had set in: National Socialism deprived German women of the rights they acquired under the Weimar constitution; in Soviet Russia, differentiation in education and opportunity between the sexes was reintroduced in 1943.

Irene Clephane

Femmes Savantes, *LES* (The Learned Women). Five-act comedy by Molière, first acted at the Palais-Royal, Paris, March 11, 1672. In it Molière returns to the theme of feminine affectation less seriously treated in his *Les Précieuses Ridicules*. The easy-going bourgeois Chrysale is at the mercy of a wife and one of his two daughters. The wife has more pretence to learning than knowledge or intelligence, and the elder daughter, Armande, is like her. Clitandre, suitor to Armande, is rebuffed, and turns to her more simple-minded sister Henriette, whom the mother wishes to marry the parlour-poet Trissotin. The *dénouement*, in which Henriette and Clitandre are united, is brought about by Chrysale's brother Aristote, who exposes the mercenary character of Trissotin. Molière acted the part of Chrysale. Trissotin is accepted as a caricature of the Abbé Cotin.

Femoral Artery (Lat. *femur*, thigh). Main artery of the thigh running from the groin to a point rather above the knee, where it becomes the popliteal artery and is continued down the leg. It gives off numerous branches, which supply the muscles and skin with blood.

Femur OR THIGH-BONE. Longest bone in the human body. Above it articulates with the pelvis to form the hip-joint, and below with the patella (knee-cap) and tibia to form the knee-joint. The superior extremity consists of a rounded eminence, the head, which fits into the *acetabulum* or socket of the pelvis, the neck, which is set at about an angle of 125° with the shaft of the bone, and two bony prominences known as the greater and lesser *trochanters*, which serve for the attachments of muscles. The shaft of the femur is somewhat convex forwards, and in the central third of the posterior surface bears a prominent ridge, the *linea aspera*, to which muscles are attached. The inferior extremity broadens out into two expansions, the internal and external tuberosities, which end in two smooth rounded articular eminences known as the condyles, separated from each other by a deep depression, the inter-condylar notch.

Fracture of the shaft of the femur is a common accident. If due to indirect violence the fracture is usually oblique; if due to direct violence, more or less transverse. Unless complicated by serious damage to the soft parts, the fracture usually unites in 6 to 8 weeks, though the leg should not be made to bear the full weight of the body for another two months. The two Great Wars saw great advances in treatment of these fractures by mechanical aids. Fracture of the neck of the femur is most often met with in elderly persons, whose bones have become weakened by atrophy. The condition is always serious in aged persons, owing to the difficulty of getting the broken fragments to unite, and to the risk of pneumonia supervening, which is always present when it is necessary to keep an elderly patient in bed for a long time. *See Hip-joint; Knee-joint.*

Fen. Anglo-Saxon word for marshy or boggy land. The district of this nature in Cambridgeshire, Norfolk, Huntingdonshire, and Lincolnshire is known as the Fens. The will o' the wisp is sometimes called the fenfire, while fenberry is another name for the cranberry.

Fence. Device used on farms for boundary purposes, to prevent stock from wandering and as a wind-screen. The proper establishment and maintenance of fences is costly; they often waste valuable ground, and neglected hedges in particular harbour vermin and weeds, the latter often serving to maintain insect and fungoid pests.

Turf fences, chiefly consisting of mud and stones, are cheap and fairly durable if properly drained and protected from the rain by coping-stones. Walls, usually of the dry sort, without cement or mortar, are much favoured where suitable flat stones are available. They last for many years if carefully built, but after 50 years or more they are liable to get out of plumb, and fall after winter frosts.

Wood and wire fences include a large number of contrivances. These may consist entirely of wood (palings, stakes, brushwood, post and rail), wood and wire, or wire with iron or concrete standards. Wood lasts much longer if treated with creosote or stop-rot composition, or simply tarred. That part of a post driven into the ground should previously be tarred.

As a general rule the owner of land is not bound to erect or maintain a fence at its boundary, but if this is the only method of

preventing his cattle from going on to a neighbour's land, it will be necessary to fence. There is usually no duty to fence land running alongside a highway; even if animals escape on to the highway and cause damage the owner of the land is in general not liable.

There is, however, a liability to fence excavations near a highway and in certain districts to fence land adjoining a street to prevent it becoming a source of danger to passengers or from being used for purposes causing annoyance to the public. Railway companies must make and maintain fences along the side of their railway. Barbed wire must not be used in fences along a highway in such a manner as to be likely to injure persons or animals. By the Barbed Wire Act, 1893, a local authority may compel the occupier of land on which there is a barbed wire fence adjoining a highway to abate the nuisance. One useful kind of wire fencing is rabbit-proof netting.

Hedges and Ditches

Hedges are particularly characteristic of many parts of England. They are costly, however, and require continual care. Hedging is an expert rural art, and involves not merely lopping of superfluous twigs and branches, but also "laying" at least every 20 years. In this process the main stems are partly cut through not far from the bottom, bent into an oblique or horizontal position, and then secured. This promotes the growth of shoots at the base of the hedge, without which it will never form a thick continuous stock-proof barrier. Equally important is the provision of a ditch adequately drained, and its maintenance in a clean condition free from weeds and rubbish. The best hedge-plant is the hawthorn (quick), while beech and hornbeam are also good.

Fenchurch Street. London thoroughfare. The name is believed to have been derived from the fenny ground in the vicinity when the Langbourne was a running brook. The street runs E. from Gracechurch Street, describing a northward curve until it meets Leadenhall Street at Aldgate Pump. At the London Tavern, rebuilt in 1877, Queen Elizabeth is supposed to have dined in 1554. Shipping companies have their headquarters in the street. Mark Lane and Mincing Lane, on the S. side, are well known in the history of commerce. Fenchurch St. station is the terminus of the line to Tilbury. The street suffered damage in the Second Great War.

Fencible. Term applied to regiments of infantry and cavalry raised in Great Britain in the late 18th and early 19th centuries for local defence in time of emergency. Numbers of fencible units were

embodied in 1804 at the time of Napoleon's threatened invasion of England. Later, certain fencible regiments, revived as yeomanry units, were eventually embodied in the Territorial Army (*q.v.*).

FENCING: ITS HISTORY AND PRACTICE

C. L. de Beaumont, Hon. Sec., Amateur Fencing Association

The graceful art of swordsmanship, sprung from methods of fighting of great antiquity, achieved a wider popularity as a sport in the course of the 19th century. It is here described in some detail

The art of swordsmanship is of the greatest antiquity. Fighting with a variety of weapons under set rules was practised among the Persians, Greeks, and Romans. Up to the 15th century, however, swords were heavy and clumsy; it was not until the general disuse of armour led to the transformation of weapons to forms better adapted for speed and neatness that fencing began to develop into an art.

During the 15th century schools and masters of fence grew rapidly in numbers and skill. Germany became the cradle of systematic swordsmanship, and the masters formed guilds such as the famous Marx brüder of Frankfort. Similar associations of professional swordsmen grew up in Spain, N. Italy, and, later, in France. The swordsmanship in these schools was of the rougher kind and many wrestling tricks were used.

The Italians were the first to recognize the superior efficiency of the point and, towards the end of the 16th century, they developed lighter weapons and nimbler and better controlled methods which spread all over Europe and developed into rapier fencing. Fencing masters discontinued the teaching of wrestling tricks, the lunge was discovered, and rapier fencing became an art.

The Science of Fencing

The rapier, although well balanced, was too long and heavy for a swordsman to make quick parries with the blade. Body movements, ducking or vaulting aside (*incartata*), were used to avoid thrusts, or the left hand protected with a gauntlet or armed with a dagger was used to parry. Right-hand attacks and left-hand parries were characteristic of rapier fencing.

A scientific system of fencing, based on mathematical lines and diagrams drawn on the floor within a circle, was established in Spain at the beginning of the 17th century.

During the reign of Louis XIV the adoption of the short court sword led to the development of

the French school of small sword fencing which rapidly displaced rapier fencing, the dagger was no longer used, and hits were made with the point only, parries being made with the blade.

Owing to the danger of injury when fencing, various conventions were established and valid hits were restricted to those arriving on the breast; many of these conventions have survived as the basis of the rules of foil fencing.

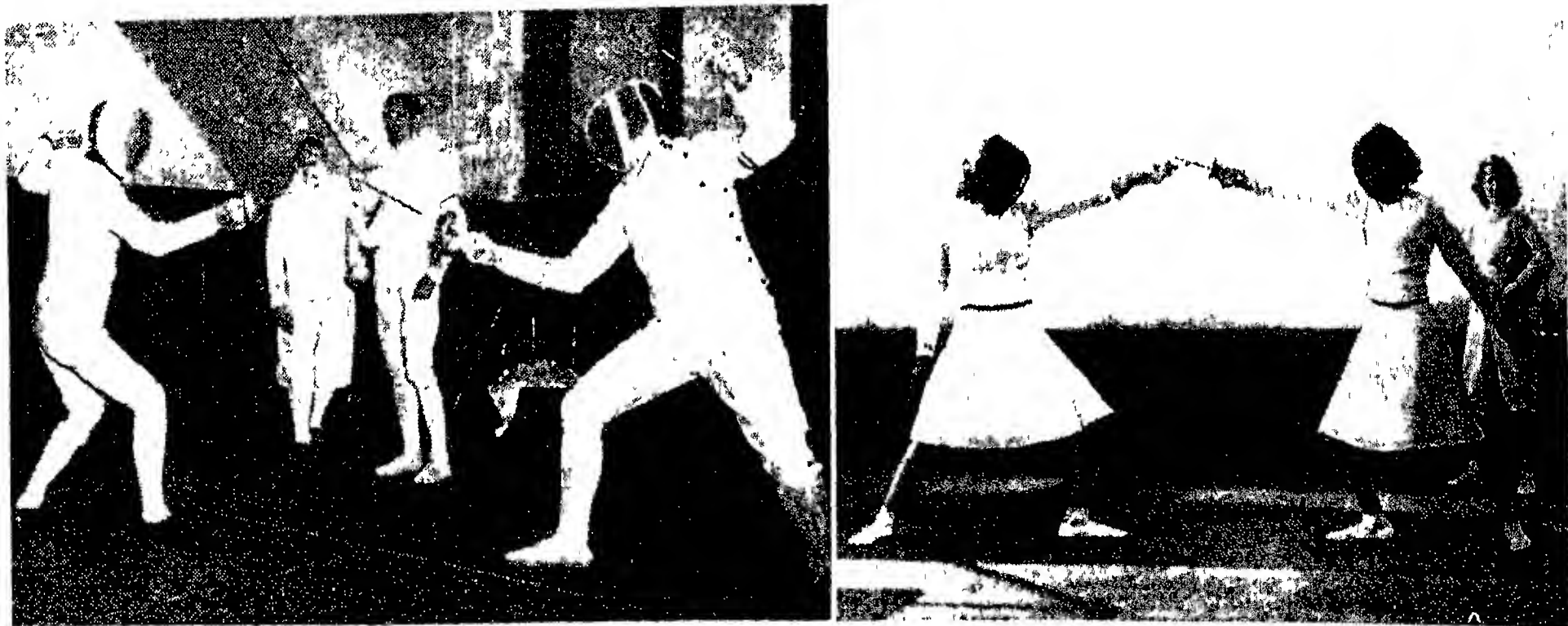
The invention of the mask by La Boëssière about 1780 permitted the evolution of complicated phrases including remise, counter riposte, and redoublement, and the development of foil fencing as we know it today.

Towards the end of the 19th century épée fencing, approximating to the conditions of a duel, was developed, while the light Italian sabre replaced the heavy military sabre which had continued the tradition of back-swording.

Teaching the Art in England

Swordsmanship was taught in England from early times. In 1285 Edward I prohibited fencing schools in London. Swordsmen continued to be regarded with disfavour until Henry VIII granted a royal charter in 1540 to the "corporation of the maisters of the science of defence and other provosts of the same science." The corporation was granted the lucrative monopoly of teaching the art of fencing in England. Sword and buckler and the long (two handed) sword became the traditional English weapons and the rapier was not firmly established here until the latter half of Elizabeth's reign. Public displays of skill with swords were popular amusements in England from the 16th century onwards. Prize fights were displays of swordsmanship until mid-Georgian days when James Figg popularised prize fights with fists. Thereafter backswording became a provincial amusement, and eventually degenerated into singlestick.

Fencing was neglected in England during the Victorian era, and



Fencing. Left; Competitors in the "on guard" position in an International Championship bout at the London Fencing Club. Right; Contestants at practice for the Girls' School Fencing Championship demonstrate that swordsmanship is as graceful an art for women as for men

it was not until the end of the 19th century that the art of fencing was revived, mainly through the enthusiasm of Captain Alfred Hutton. The first amateur championships with foil and sabre were held in 1898, and in 1901 the Amateur Fencing Association was founded. From 1919 to 1939 fencing increased markedly in popularity throughout Great Britain, both for men and women, a large number of championships and competitions were held annually, and British fencers were represented in all the important international meetings including the Olympic games.

Fencing today is practised with three weapons, the foil, the épée, and the sabre. Foil fencing is the basis for the practice of sword play with all three weapons. At foil and épée hits must be made only with the point, at sabre hits are made with the point or with the edge (cuts) or with the first third of the back edge.

The Foil and the Sabre

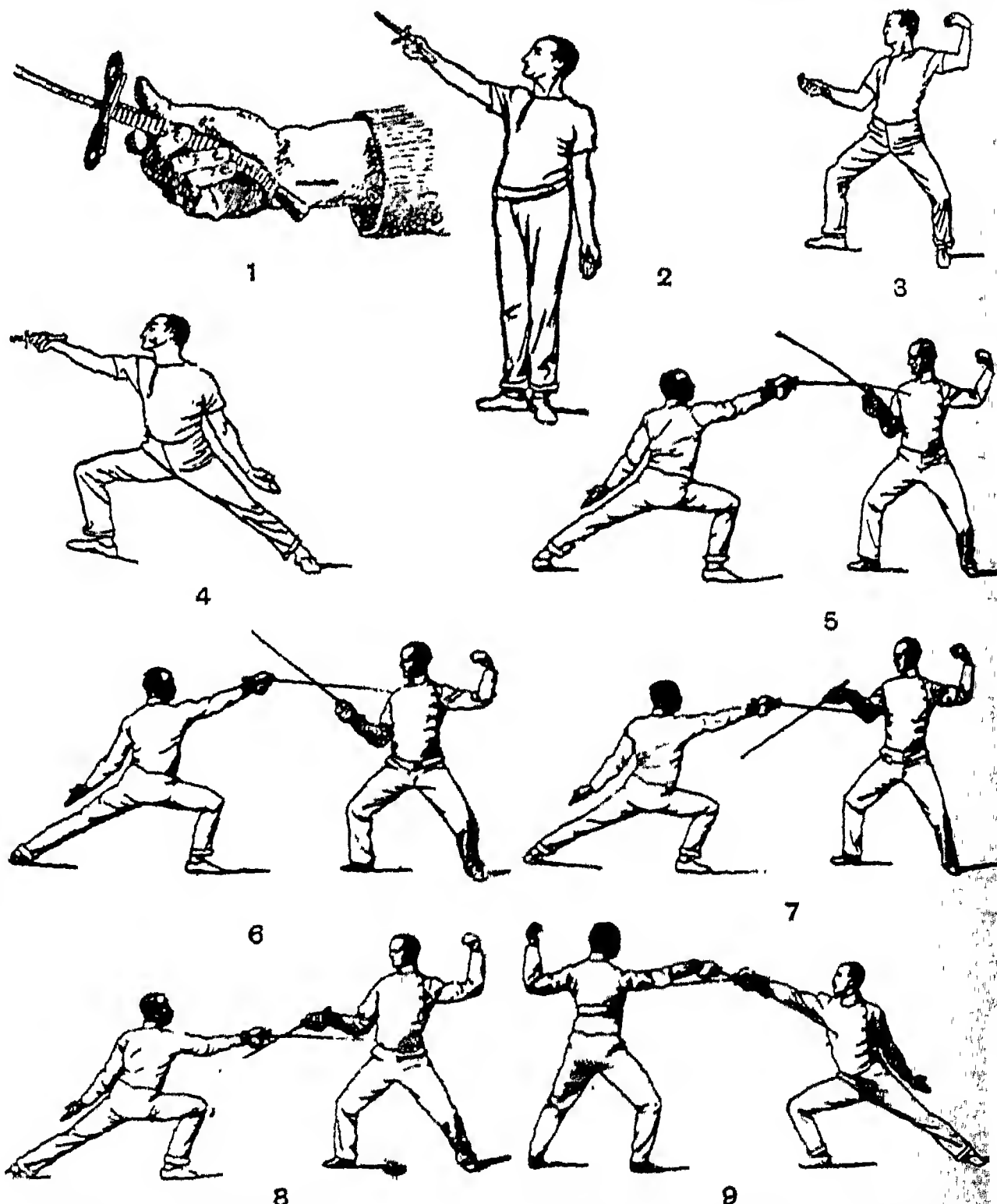
Fencing with the foil and the sabre is subject to the following conventions: (a) the target is limited: at foil, the trunk only, back or front; at sabre any part of the head, arms, or trunk approximately down to the waist; (b) all hits made direct on a part of the body other than the target stop the phrase and annul all subsequent hits; (c) all correctly executed attacks must be parried or completely avoided, and the phrase must be followed through.

Fencing with the épée reproduces, as far as possible, the conditions of a duel: the target includes every part of the fencer, and there are no conventions.

Each weapon consists of a blade and a mounting, which includes

the guard and the handle through which passes the tang of the blade at the end of which the pommel or locking nut is attached. A small cushion is generally fixed inside the guard as a protection for the fingers. The stronger part of the blade, *i.e.* the part nearest to the guard, is called the forte, while the remainder of the blade is known as the faible.

There are two main varieties of foils and épées — French and Italian. The French weapon has a plain handle and is manipulated by delicate finger work. The Italian weapon has a cross bar and two rings attached to the inner surface of the guard through which the first two fingers are placed, the pommel being strapped to the wrist. Fingerwork is largely



Fencing. 1. Position of hand on foil. 2. Preliminary position. 3. On guard. 4. Lunge. 5. Parry of quarte. 6. Parry of sixte. 7. Parry of septime. 8. Parry of octave. 9. Riposte from parry of quarte

sacrificed to added strength in manipulating the weapon.

Foils usually have bell guards or a double loop guard. Épées have bell guards which may be decentralised to give added protection to the outside of the sword arm. The guard of the sabre is curved to protect the hand from cuts. The flattened point or button of the foil must be covered with waxed thread. A triple steel point (*pointe d'arrêt*) is fixed to the button of the épée so that hits made on the opponent's clothing shall not glance off. An electrical judging apparatus is used in the major épée events. A martingale (a loop of cord attached to the handle and passed round the fingers) is obligatory to obviate accidents to onlookers if a fencer is disarmed.

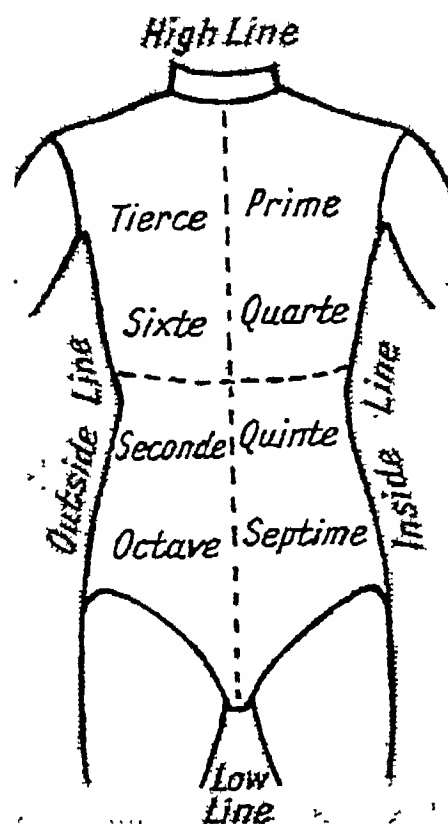
Clothing is usually made of light canvas (sail cloth) and must be white. The head is protected by a mask with canvas bib, and a glove or gauntlet is worn on the sword hand. A leather elbow guard should be worn at sabre. Canvas shoes should have leather soles in fencing on a linoleum floor, but rubber soled shoes are preferable on a wooden floor or out of doors. Foil and sabre competitions usually take place indoors on linoleum or cork strips; épée events in the open air on gravel or levelled soil. That portion of the field of play which is used for fencing is called the *piste* or fencing strip.

In fencing, an attack is made by straightening the arm with the point of the sword threatening the opponent, and lunging. The fencer defends his target by using his weapon to deflect his opponent's blade: this action is called a parry. When an attack is parried the fencer who has parried in his turn straightens his sword arm in order to hit his opponent: this action is called a riposte.

A direct thrust at the target will generally be parried. The real attack is usually preceded by one or more false attacks or feints designed to make the opponent parry too soon so that the attacker may deliver his real attack on some part of the target which his opponent leaves uncovered.

The target (trunk) is divided

by imaginary lines at right angles to each other. One line crosses the centre of the body from left to right; that part of the body above the line is called the high line, that part below is called the low line. The other line passes downwards from the centre of the



Fencing. Target for a right-handed fencer. A left-handed fencer must visualise the diagram in reverse

neck; that part of the body on the sword arm side of this line is called the outside line, that on the other side is called the inside line. (See diagram.)

There are eight parries at foil and épée—two to protect each quarter of the target. The position of the hand in relation to the target when forming some parries are indicated approximately in the drawings in p. 3294. Four of these parries are made with the hand in supination (palm upwards): sixte, quarte, octave, and septime; and

four with the hand in pronation (palm downwards): prime, tierce, seconde, and quinte. Parries may be simple, or the opponent's blade may be deflected by a circular movement in the same line called a counter parry.

Variety of Attacks

Attacks may be simple, e.g. a direct thrust or a thrust made along the opponent's blade (*coulé*), a disengagement by passing the blade under the opponent's blade, or a cut-over (*coupé*) passing over the opponent's blade, or may be made after pressing, beating, or binding the opponent's blade, or may be composed attacks, i.e. preceded by one or more feints or by circular movements called the *doublé* describing a circle round the opponent's blade when he attempts to counter parry.

There are thus a variety of composed attacks using the movements of simple attacks, attacks on the blade, and the *doublé* either as feints or for the final movement. Similarly, after an attack has been parried, the riposte may be direct or by disengagement, or may be preceded by one or more feints, etc. The counter-riposte is a riposte made by the original attacker after parrying his opponent's riposte. The *remise* is the immediate continuation of the attack in the same line after the opponent has parried. When an attack or a riposte is delayed or is

preceded by a number of feints, a stop thrust or time thrust (*coup d'arrêt*) may be made. Attacks of second intention are then made after drawing the opponent's stop hit or attack and parrying the same, afterwards launching a counter attack.

At épée, the large target and the absence of conventions make it unwise to employ any wide movements such as the cut-over or attacks preceded by a number of feints because such movements expose the attacker to stop hits on the arm. Attacks and ripostes as well as stop and time thrusts tend to be concentrated on the nearest portion of the target, i.e. the opponent's wrist or sword arm. Since double hits count against each fencer, the cardinal rule at épée is to hit your opponent without yourself being hit.

Speed and Precision

The épée fencer must develop a sense of timing, judgement of distance, suppleness, speed of footwork, and speed, accuracy, and precision in placing his hits. The *flèche* attack is a running movement designed to hit the opponent by speed and surprise. It must be exceedingly well timed and requires sound judgement and great precision. Sabre play differs from foil and épée in that the edge is used as well as the point; in choice of time and distance it approximates more to épée than to foil. Simple movements and speed of footwork are essential. There are six parries, and second intention attacks are much used.

Fencing more than almost any other sport has to be learned by actual practice under an instructor. Fencing competitions are judged by a jury consisting of a president, who directs the bout and alone decides on the validity of a hit according to the rules and conventions of fencing and as to the priority between two hits on time at épée, and four judges; two judges watch each competitor and advise the president when a hit is scored on the fencer they are watching.

In individual competitions, the competitors are drawn in pools of six or eight fencers at foil and sabre and eight to twelve fencers at épée. Every competitor fences against every other competitor in the pool in a pre-arranged order of bouts, and the classification is determined according to the number of victories awarded by the president to each fencer.

Teams usually of three to five fencers are drawn against each

other. Every member of one team fences against every member of the other team in a pre-arranged order of bouts. The result is determined by the number of victories (and if necessary the number of hits received and scored) by all the members of each team. Foil and sabre bouts are usually for the best of seven or nine hits. Épée bouts, formerly for one hit, are now usually for the best of three or five hits. The rules of the International Fencing Federation have been adopted by the Amateur Fencing Association for use in Great Britain.

Fender. Article of domestic furniture. Used as a guard against the falling of hot cinders from the

mins. at the Oval in 1922, and several times took over 100 wickets in one season. He wrote several books descriptive of international cricket, and was a prolific contributor to the press and a popular broadcaster on cricket.

Fénelon, FRANÇOIS DE SALIGNAC DE LA MOTHE (1651-1715). French ecclesiastic, author, and academician. He was born near Sarlat, Aug. 6, 1651. Ordained priest in 1675, he was director of the convent of the Nouvelles Catholiques, and missionary to the Protestants in the disturbed provinces of Poitou and Saintonges, the fascination of his personality, and his mixing of bribery and kindness, being great factors in his success.

boundaries should divide literature, politics, and religion; and his writings cover a wide range. The best

known is the didactic romance, *Les Aventures de Télémaque*, 1699, which, like his *Fables* and his *Dialogues des Morts*, was designed to instruct his



François de Fénelon,
French prelate
After Vivien, Louvre

royal pupil in the conduct of life and the responsibilities of absolute government. His *Éducation des Filles*, 1687, has also a place in the pedagogical literature of the time. Consult *Lives*, Viscount Saint-Cyres, 1906; P. E. R. Janet, Eng. trans. 1914; *The Archbishop and the Lady*, M. de la Bedoyère, 1956.

Feng-huang-cheng. City of China, in the province of Liaoning. On the Mukden-Antung rly., it was opened to international trade by agreement between China and Japan, 1905. Pop. 51,000.

Feng-siang. Town of China, in the prov. of Shensi. It is perched on a high loess terrace on the main road from Peking to Lanchow.

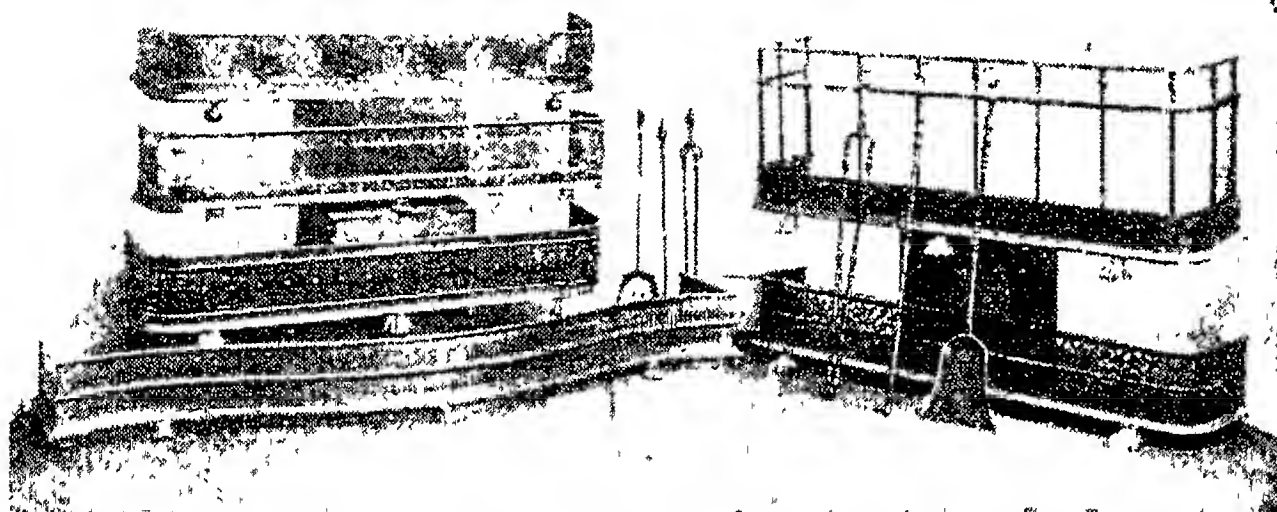
Fengtien. Former name of Liaoning (*q.v.*), a prov. of China.

Feng-yang. City of China, in the prov. of Anhwei. It was the birthplace of the Mings, but the first emperor transferred his capital to Nanking.

Fen-ho. River of China, in the prov. of Shansi. It is a tributary of the Yellow River.

Fenianism. Name given to the revolutionary movement springing from the Fenian brotherhood. Its real name was the Irish Revolutionary Brotherhood. One of the organizers, O'Mahoney, gave it the name of the Fenian Society. This name was derived from the semi-legendary warrior bands (Fianna) of early Irish history. The society was really a political association of Irish and Irish-Americans whose object was to overthrow British government in Ireland and establish a republic there. There was an American branch and an Irish branch. It has been said that the movement began in America, but really the plans for both branches were drawn up in Paris by a band of Irish revolutionaries in 1848.

The Irish famines in the 'forties caused a great emigration to America, and the emigrants laid the blame for their exile on the British government, which had



Fender. Examples in domestic use. Steel and brass fenders of the 18th century
By courtesy of Gill & Reigate

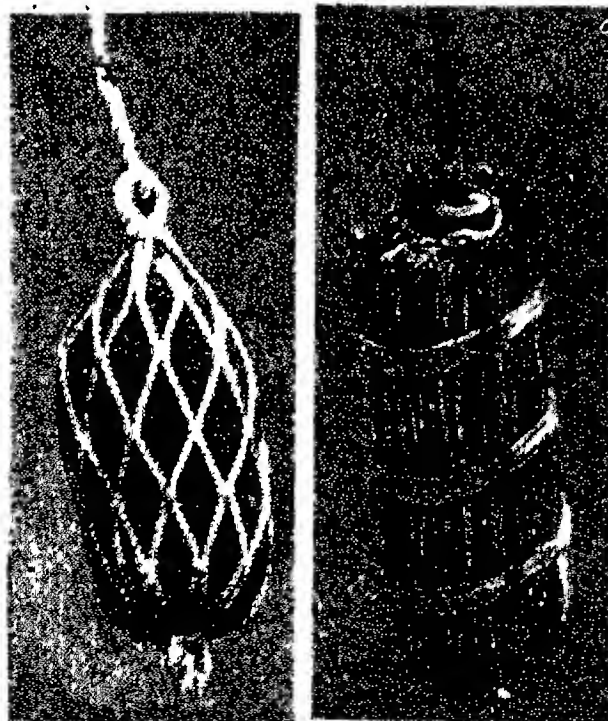
fire into the room, it came into use upon the introduction of grates raised from the floor, and it superseded the old shallow kerb which enclosed the open stone hearth. The growing popularity of sunken grates and tiled fireplaces in the 20th century has led to a lessening of the need for fenders and a reversion to the shallow curb, usually of tile material, or often no curb at all is used.

Fender. Nautical term for a bundle of sticks, rope, or wood dropped over a vessel's side to prevent her from rubbing against another vessel or the wall of a quay. Hence the expression to fend off, *i.e.* to keep away, to protect. A "pudding fender" is a large ball of old rope used as a fender.

Fender, PERCY GEORGE HERBERT (b. 1892). English cricketer. Educated at S. George's college, Weybridge, and S. Paul's school, he entered first class cricket in 1910, when he played for Sussex, and by 1914 was a member of the Gentlemen's XI against the Players. He toured Australia with the M.C.C. team in 1920-21 and South Africa in 1922-23. He captained Surrey from 1921 to 1932. Equally useful as a bowler and a fast scoring batsman, Fender made his highest score of 185 in 2 hrs. 10

In 1689 he was appointed preceptor to Louis XIV's grandson, the duke of Burgundy, and in 1695 was made archbishop of Cambrai. Soon after this his interest in quietism and defence of its leader, Mme. Guyon, brought him into collision with his old friend Bossuet, who, after a bitter controversy, obtained the condemnation by Rome (1699) of his offending volume *Explication des Maximes des Saints sur la Vie Intérieure*. Fénelon died Jan. 7, 1715.

Fénelon was a man of great versatility, who did not believe that



Fender (nautical). Left, rope fender in net; right, fender of hazel wood bound with wire

been painfully unsuccessful in its efforts to cope with distress. The sentiment of hatred towards England was fomented by James Stephens and others, who had escaped after the abortive Young Ireland insurrection of 1848. The organizers knew that open rebellion against the armed forces of the British government could bring only disaster, but were persuaded that justice could not be won by peaceful methods. Therefore they held it justifiable to foster "secret warfare"—which those who did not sympathise called outrage and assassination. Their aim was purely political; being neither religious nor agrarian, it appealed neither to the priesthood nor to the peasantry.

Stephens returned to Ireland to organize the society there while the real headquarters remained in America. In the American Civil War, which ended in 1865, numbers of American Irish had learnt the business of fighting. An active secret propaganda was set to work in Ireland; but the authorities seized the offices of "The Irish People," and arrested sundry ring-leaders. In 1866 some hundreds of American Irish attempted to



Fennec. Small fox found in the deserts of North Africa

raise an insurrection in Canada, but failed completely, receiving none of the support expected from the U.S.A. government. Another effort, however, had been prepared in England and Ireland. In Feb., 1867, a plan to seize the arsenal in Chester Castle was forestalled by drafting troops to that city.

In Sept., two Fenians were arrested in Manchester on charges of felony. A rescue was attempted, the prisoners escaped, and a police officer was killed, but 29 Fenians were arrested and three of them were hanged for the murder of the sergeant, which had not been intended, and of which the men convicted had been guilty only in a technical sense. These men

became known as the Manchester Martyrs. A worse crime was the blowing up of a part of Clerkenwell prison on Dec. 13. The brotherhood after this time became merged in other societies of a similar character, such as Clanna-Gael (*q.v.*), and the Irish Republican Brotherhood. See Ireland, History.

Fenn, GEORGE MANVILLE (1831–1909). A British story-writer for boys. He was born at Westminster Jan. 3, 1831, and educated at private schools. Having contributed to popular periodicals, he was in 1870 appointed editor of Cassell's Magazine, and in 1873 became proprietor of

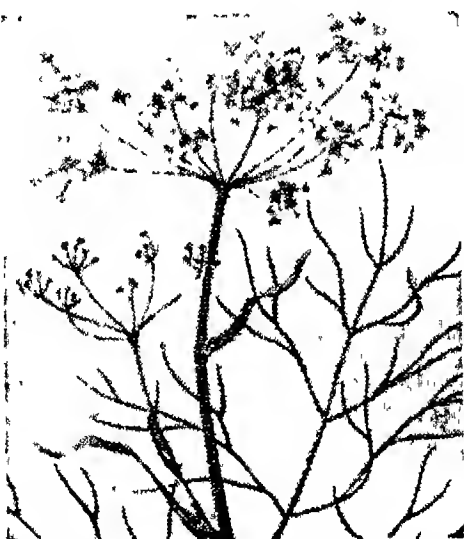


G. Manville Fenn, British novelist
Elliot & Fry

Once a Week. His published work totalled close upon 200 volumes and included numerous stories told in pleasant narrative style, among them being *The Sapphire Cross*, 1871; *The Parson o' Dumford*, 1879; *Off to the Wilds*, 1881; *Nat the Naturalist*, 1883; *Bunyip Land*, 1885; *The Bag of Diamonds*, 1887; *A Crimson Crime*, 1899. Fenn died Aug. 26, 1909.

Fennec (*Canis zerda*). Small foxlike member of the dog family, found in N. Africa. The ears are enormously long. The colour is a very pale buff, with white beneath and a black tip to the tail. Fennecs live in burrows in the desert and feed at night on birds, lizards, and small mammals.

Fennel (*Foeniculum vulgare*). Tall perennial herb of the family Umbelliferae. It is a native of Europe, N. Africa, and W. Asia. The leaves are much divided into thread-like segments. The tubular but almost solid stem is 3 ft.–4 ft. in height, crowned with compound umbels of minute yellow flowers. The fruits are compressed from side to side. The leaves are used as a pot-herb, and for garnishing dishes, and the fruit supplies an aromatic oil possessing carminative properties.



Fennel. Flower-head and leaf of *Foeniculum vulgare*

Fenny Stratford. This town of Bucks, England, is part of the urban district of Bletchley (*q.v.*).

Fens, THE. Extensive flat and low-lying region of England, 70 m. in length and

35 m. in extreme breadth, occupying parts of several counties in the neighbourhood of the Wash. They represent the silted up portion of a bay of which only the Wash is left, and systematic drainage at various periods has rendered them extremely fertile. The Romans attempted to drain the Fens by constructing causeways and throwing up immense embankments along the rivers and the seashore, but the sluices were gradually choked and the district again became water-logged, serious inundations by the sea occurring at intervals down to the second half of the 16th century.

In 1634, Francis, earl of Bedford, and thirteen co-adventurers employed a Dutch engineer, Vermuyden, to drain the area now known as the Bedford Level (*q.v.*). It was not until 1807, however, that the effectual draining of the entire region was finally accomplished, the Holland and neighbouring fens having been reclaimed in 1767, the Witham Fens in 1807, and the Welland Fens almost totally reclaimed by 1801. Grain, flax, cole-seed, and potatoes are extensively cultivated, and wild-fowl abound. The Fen country is the home of English skating. During the second half of the 7th century, Peterborough, Ely, Ramsey, Thorney, Crowland, etc., were settled by various monastic orders, who erected churches, monasteries, and abbeys. Great damage was caused by floods in the early spring of 1947.

Fenton. This parish of Staffordshire, England, is part of the city of Stoke-on-Trent (*q.v.*).

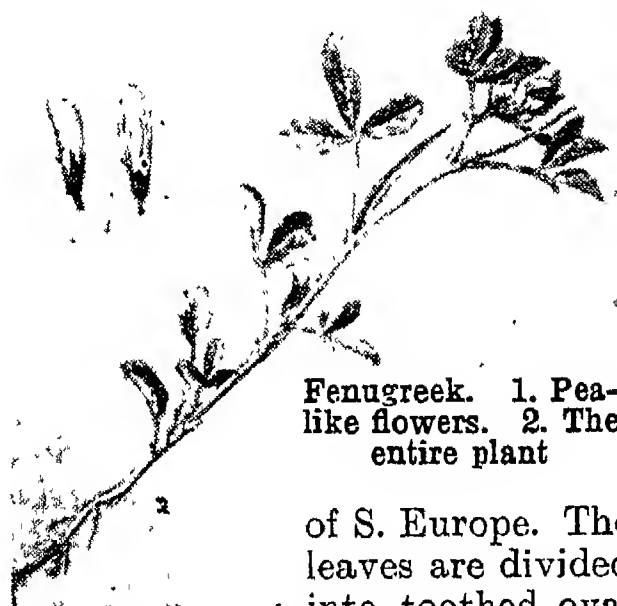
Fenton, LAVINIA (1708–60). An English actress. She made her first appearance in 1726 as Monimia in Otway's *The Orphan*. Her beauty, voice, and charm soon made her a reigning toast, and her success as Polly Peachum in Gay's *Beggar's Opera* (Jan. 29, 1728) at Lincoln's Inn Fields was such that the opera was played 62 times during the season. The 3rd duke of Bolton married her in 1751. She died on Jan. 24, 1760.



Lavinia Fenton, English actress
After Hogarth

Fents (Fr. *fente*, slit). Remnants of cloth from one yard to a few yards in length. They are too short for sale in a regular way, and are generally sold by weight.

Fenugreek (*Trigonella foenum graecum*). Annual herb of the family Leguminosae. It is a native



Fenugreek. 1. Pea-like flowers. 2. The entire plant

of S. Europe. The leaves are divided into toothed oval leaflets, flowers pea-like, white, on unbranched stems, 1 ft. to 2 ft. high. The plant, whose name means Greek hay, has the odour of new-mown hay, into which it was made by the ancients. The seeds are used in veterinary medicine.

Fenwick, CHARLES (1850–1918). British politician. Born at Cramlington, Northumberland, May 5, 1850, he worked on the pit-bank at the age of nine, and on his tenth birthday became an underground labourer. A miner until 1885, he educated himself in his spare time, and held offices under the Northumberland miners' association. He was elected to parliament as Liberal-Labour candidate for Wansbeck in 1885. He was secretary of the parliamentary committee on Trades Unions, 1890, and served on the parl. Coal Dust commission, 1891, and the royal commission on Secondary Education, 1894. He represented Wansbeck until his death, April 22, 1918.

Fenwick, SIR JOHN (c. 1645–97). English conspirator. Of an old Northumberland family, he



Sir John Fenwick, English conspirator
From an engraving

early entered the army. Becoming major-general in 1688, he sat in parliament for his native county, 1677–85. Against William III Fenwick is said to have had an old personal grudge, perhaps reciprocated, and in 1696 he was arrested in connexion with an assassination plot. In his confession he cast aspersions on many prominent Whigs. He was attainted and beheaded on Tower Hill, Jan. 28, 1697.

Feodor OR **THEODORE** (1575–98). Tsar of Russia. The son of Ivan the Terrible, he was born

May 11, 1557, and came to the throne in 1584. Mentally deficient, he was never capable of ruling, and was under the direct influence of his brother-in-law, Boris Godunov, who, upon Feodor's death, Jan. 7, 1598, ascended the throne. Another tsar of the same name was half-brother of Peter the Great and was succeeded by him in 1682.

Feodosia OR **THEODOSIA**. Town and harbour on the E. coast of the Crimea, Ukraine S.S.R., 70 m. E. of Simferopol and linked by rly. with Kerch. The industries are connected with soap, carpets, leather, and caviare. An old colony of Miletus, about 1270 Feodosia became a Genoese emporium, but was taken by the Turks in 1475. Annexed to Russia in 1770, it was developed as a resort. In the Second Great War it was evacuated Nov. 5, 1941; retaken from the Germans Dec. 30; lost to them next month; and regained by the Russian Maritime Army, April 13, 1944.

Feoffment. In England, the common law method of transferring a fee, or freehold. It was a symbolical placing of the transferee in possession of the estate by delivering it to him. If it were a house, the transferor might hand him the key of the front door. If it were land he would hand him, on the land itself, a sod, or a twig, saying, "I liver this to thee in the name of seisin of Whitacre, which is bounded by" (here he would name the boundaries of the estate), "to have and to hold to thee and thy heirs," or for life.

It became customary to set out the boundaries, etc., in a deed on parchment, sealed with the seal of the parties, and then the feoffment was somewhat in this form, "I liver this (sod, twig, etc.) to thee in the name of all the lands set out in this my deed," at the same time handing over the deed, charter of feoffment. The Statute of Frauds (Charles II) made some writing necessary on the sale of land; but livery of seisin or feoffment was still necessary as well. To evade the necessity for feoffment the device was introduced of employing two deeds, (1) a lease to the transferee, and (2) a release to him of the reversion. Neither lease nor release required feoffment. By the Real Property Act, 1845, conveyances of freeholds are made lawful by deed of grant.

Ferber, EDNA (b. 1887). American novelist and dramatist. Born at Kalamazoo, Mich., Aug. 15, 1887, she was educated at Appleton, Wis., and at 17 became a

reporter. Beginning her literary career as a short story writer, she achieved her first popular success (in collaboration with G. V. Hobart) with *So Big*, 1924, a representation of American provincial life which won the Pulitzer prize. Her novel *Show Boat*, 1926, dramatised and filmed, had brilliant runs in New York and London; *Cimarron*, 1930, was filmed. In collaboration with G. S. Kaufman she wrote plays notable for their wit and characterisation, which were equally successful as films, e.g. *Dinner at Eight*, 1932; *Stage Door*, 1936. Other books were *Saratoga Trunk*, 1941 (also filmed); *Great Son*, 1945.

Ferberite. The iron-rich end-member of the wolframite mineral group. Chemically it is iron tungstate, FeWO_4 , with subordinate amounts of manganese. See *Wolframite*.

Ferdinand I (1503–64). German king and Roman emperor. Born at Alcala de Henares, Spain,



Ferdinand I, German king
After Titian

March 10, 1503, he was the younger son of the archduke Philip and of Joanna of Castile. He was thus a Hapsburg, a grandson of the emperor Maximilian and a brother of Charles V. After Charles was chosen emperor in 1519, Ferdinand was given territories in Germany and helped his brother in the work of government. In 1521 he married Anna, daughter of the king of Hungary and Bohemia, and when her childless brother Louis was killed in 1526 he put himself forward as his successor. In both lands he was chosen and crowned; but in Hungary he had for long little more than the name of king.

It is from Ferdinand, not from Charles, that the modern Hapsburgs are descended. The brothers agreed that on the elder's death Ferdinand should succeed him in Germany, leaving to Charles's son Philip only Spain and its colonies. Ferdinand, therefore, was chosen German king in 1531, and when Charles abdicated in 1556 the arrangement was carried out. In the intervening years Ferdinand was fighting for Hungary and dealing as best he could with the religious disorders in Germany and Bohemia. He was useful to Charles after the latter's humiliation at the hands of Maurice of Saxony, and arranged with the Protestants the peace of

Augsburg. His own reign as emperor (1558-64) saw but a continuance of his war with the Turks and of his efforts to settle the religious differences. He died in Vienna, July 25, 1564, his eldest son, Maximilian II, succeeding him.

Ferdinand II (1578-1637). German king and Roman emperor. Born at Graz, July 9, 1578, he



Ferdinand II,
German king

From an old engraving

was a son of the archduke Charles and a nephew of the emperor Maximilian II. Educated by the Jesuits, he began his public life as ruler of Styria and Carinthia, the portion of the Hapsburg domains that had been his father's share. His rule was chiefly distinguished for his persecution of the Protestants. In 1612 the emperor Rudolph, Ferdinand's cousin, died, and another cousin, Matthias, became emperor. He was old and childless, and the outcome of much political strategy was the decision that Ferdinand, and not one of his own brothers, should succeed him. The family agreed to the arrangement, and as a beginning the archduke was chosen king of Bohemia and king of Hungary. Matthias died in 1619 and in Aug. his nephew was elected German king.

Meanwhile, in 1618, the Thirty Years' War had begun. Frederick, Elector Palatine, set up as a rival to Ferdinand by the Protestants, started the struggle that lasted throughout the emperor's life. Ferdinand acted vigorously, and until the appearance of the Swedes, aided by Maximilian of Bavaria, he was completely victorious. He recovered Bohemia, put an end as far as possible to Protestantism, and by the edict of 1629 gave back lands taken from the Church. The Swedish intervention followed, and in 1635 the emperor made the treaty of Prague with some of his foes. He died Feb. 15, 1637, leaving, by his wife, who was a Bavarian princess, two sons—his successor, Ferdinand III, and Leopold, a prelate. See Thirty Years' War.

Ferdinand III (1608-57). German king and Roman emperor. Son of the emperor Ferdinand II, he was born at Graz, July 13, 1608. To secure his position his father had him crowned king of Hungary and king of Bohemia during his own lifetime, and in 1636



Ferdinand III,
German king

he was chosen German king. In 1637 his father died and Ferdinand became the real ruler of these kingdoms and assumed the title of emperor. The Thirty Years' War, in which he had taken part, was then raging, and his reign saw its end in 1648. He died April 2, 1657, and was succeeded by his eldest surviving son, Leopold I.

Ferdinand (1861-1948). Tsar of Bulgaria. Born at Vienna, Feb. 26, 1861, he was the youngest son of Augustus, prince of Saxe-Coburg-Gotha, and Clementine, daughter of Louis Philippe. He was well educated, and with his brother Augustus published a book on his botanical observations in Brazil. He entered the Austrian army, but soon his ambition led him in another direction. In 1887 Alexander, prince of Bulgaria, abdicated, and after much intrigue Ferdinand was chosen as his successor. Russia was opposed to him, but he won through and by 1896 most of the objections to him had ceased. In 1908 he proclaimed the independence of Bulgaria, and called himself king or tsar, winning recognition from the powers shortly afterwards. He was an advocate of the Balkan League, and was one of the instigators of the war of 1912-13.

On the outbreak of the First Great War, Ferdinand was cautious enough to await developments before committing himself to any definite policy. His strong German tendencies gradually became more apparent, however, and finally, having exhausted all the prevarications of diplomacy, he declared war, Oct. 13, 1915. He played no conspicuous part in the war itself, and, on the final breakdown of the Bulgarian effort, he abdicated, Oct. 4, 1918, in favour of his son Boris, and retired to Germany. Ferdinand married in 1893 a daughter of the duke of Parma; and in 1908 a princess of Reuss. He died Sept. 10, 1948.

Ferdinand (1865-1927). King of Rumania. Born at Sigmaringen, Aug. 24, 1865, he was a son of

he was chosen German king. In 1637 his father died and Ferdinand became the real ruler of these kingdoms and assumed the title of emperor.

Leopold, a member of the non-reigning and Roman Catholic branch of the Hohenzollern family. In 1866 his uncle Charles had been chosen king of Rumania, and as his heir Ferdinand became king in Oct., 1914. The First Great War was then raging, but it was not until 1916 that Rumania joined in on the side of the Allies. The land was soon overrun by Austro-Germans, and during the difficult period that followed there were rumours of the king's abdication; but these did not materialise, and



Ferdinand,
King of Rumania

the end of the war saw him again in possession of his country. He married in 1893 Marie, cousin of George V, and died July 20, 1927.

Ferdinand. Name of several kings of Spain and Naples. Other than those who are given separate biographies, the principal are Ferdinand I (d. 1065), El Magno, or the Great, who became king of Castile in 1028; Ferdinand II (d. 1188), king of Leon; and Ferdinand IV (d. 1312), king of Castile. Of the Neapolitan kings, Ferdinand I (1423-94) was the natural son of Alphonso V of Aragon and I of Sicily. He succeeded to the throne by the will of his father. His reign was troubled by the jealousy of the other Italian states, wars with the Turks, and difficulties with France. His grandson, Ferdinand II (1469-96), was temporarily dispossessed by Charles VIII of France. The Bourbon Ferdinand III (1751-1825), king of Sicily, welded the titles of Naples into one and became Ferdinand I of the Two Sicilies.

Ferdinand III (1199-1252). King of Castile and Leon, called the Saint. Son of Alfonso IX of Leon and Berengaria of Castile, he succeeded his cousin Henry as king of Castile in 1217, and showed himself a prudent ruler. In 1231 the death of his father brought him the throne of Leon, and as king of Castile and Leon he waged war against the Moors, confining them to Granada, and securing Seville in 1248. He was canonised by Clement X in 1671 on account of his unflinching orthodoxy in repressing the Albigenses, and for his services towards the Crusades.

Ferdinand V (1452-1516). King of Spain. Known as Ferdinand of Aragon, he was the son of John II, king of Aragon and Sicily, and was



Ferdinand,
Tsar of Bulgaria

born March 16, 1452. He was assigned the Sicilian kingdom in 1468, and succeeded his father as Ferdinand II of Aragon in 1479. In 1469 he had married Isabella, sister of Henry IV of Castile, the recognized heiress to the Castilian throne. Henry died in 1474, and Isabella was established as queen of Castile in 1479, the year in which Ferdinand succeeded to the crown of Aragon. There were now in the



Ferdinand V,
King of Spain

From a contemp. portrait

Spanish peninsula five kingdoms: the Moorish dominion of Granada, Portugal, Navarre, Castile, and Aragon. The last two kingdoms were under one crown, though retaining separate governments. A long war with Granada ended triumphantly with its annexation in 1492; and in 1512 Ferdinand acquired almost all of Navarre.

Thus during his reign the entire peninsula, except Portugal, was brought under a single dominion. Sicily was already attached to the kingdom of Aragon, to which S. Italy or Naples was added by the ousting of the French in 1504. Further, the discovery of America, 1492, by Columbus, under the auspices of Ferdinand and Isabella, secured what was almost the monopoly of the New World to Spain, which had thus been raised to the position at least of equality with France. Isabella was something more than the partner of Ferdinand in the expansion of their joint dominion and in bringing each of their separate kingdoms under the effective control of the crown. She rendered ill service to Spain, however, by introducing the Inquisition (*q.v.*) in 1480. The expulsion of the Jews and the harsh restrictions imposed upon the Moors were also highly injurious. The course of future events was greatly influenced by the marriage of the elder daughter Joanna to Philip, duke of Burgundy, heir to the Austrian Hapsburgs, and of the younger, Catherine, to Henry VIII of England, after her betrothal to his brother Arthur, prince of Wales.

Ferdinand was noted as the craftiest sovereign of his day, his only rival in that quality being Henry VII of England, with whom he was usually joined in an alliance in which each sought the maximum advantage at the other's expense. After the death of Isabella, 1504, Ferdinand's craft degenerated

into mere cunning. The crowns of Castile and Aragon were actually parted when Isabella died; but Joanna, duchess of Burgundy, was heiress of both, and her place was taken by her son, afterwards Charles V. Except during a brief interval, Ferdinand retained the government of Castile as regent until his death, Jan. 23, 1516. The character of Ferdinand is summed up in the story of his reply when told that Louis XII complained that he had cheated him once. "He lies: I have cheated him thrice." *Consult History of the Reign of Ferdinand and Isabella*, W. H. Prescott, ed. J. F. Kirk, repr. 1902.

Ferdinand VI (1712-59). King of Spain. The second son of Philip V, he was born Sept. 23, 1712, and ascended the throne in 1746. He immediately set himself to carry out internal reforms, having first concluded the peace of Aix-la-Chapelle, 1748. At the outbreak of the Seven Years' War in 1756 he declared his neutrality. Three years later, broken-hearted at the loss of his wife, Maria of Portugal, his reason gave way, and he died Aug. 10, 1759. The crown of Spain passed to his half-brother, Charles III of Naples.

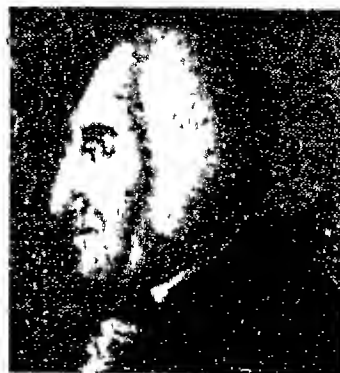
Ferdinand VII (1784-1833). King of Spain. Son of Charles IV, he was born Oct. 14, 1784, and five years later became prince of Asturias. In opposition to his father, in 1806 he approached the court of France with the project of marrying one of Napoleon's



Ferdinand VII,
King of Spain

nieces. He was imprisoned by his father, but the French invasion of Spain caused the latter to abdicate in Ferdinand's favour in 1808. Charles, however, appealed to Napoleon, and withdrew his abdication, and Ferdinand went into retirement. After the Peninsular War in 1814 Napoleon reinstated Ferdinand. A reign of terror followed, and such chaos and rebellion prevailed that in 1823 a French army was sent to establish Ferdinand on his throne. To secure the succession for his daughter, Isabella, in 1830 he abolished the Salic law as applying to the Spanish throne, thus excluding his brother Carlos, an act which led to grave complications later. He died Sept. 29, 1833, and Isabella came to the throne under the regency of Maria Christina. See *Carlists: Spain: History*.

Ferdinand I (1751-1825). King of the Two Sicilies. Born in Naples, Jan. 12, 1751, when his father ascended the Spanish throne as Charles III in 1759, he became his successor as king of Naples and of Sicily. In 1768 he married Maria



Ferdinand I, King
of the Two Sicilies

Carolina of Austria, and was completely dominated by her violent and tyrannical nature.

After the short-lived Parthenopean Republic (1799), in the bloody repression of which Nelson, deluded by Lady Hamilton and Maria Carolina, played a part, Ferdinand oppressed his subjects still more. He aided the Austrians against Napoleon, who sent troops to occupy Naples, whereupon Ferdinand fled to Sicily, and Joseph Bonaparte was proclaimed king in his place. In 1815 Murat, who had succeeded Joseph as king in 1808, was deposed, and Ferdinand returned to vent his spite on the populace by the indulgence of an inconceivable tyranny and cruelty. Uniting Naples and Sicily, he became the first king of the Two Sicilies. At the suggestion of the European powers he promised various reforms, but consistently with the whole tenor of his life he broke all his oaths and repudiated his own signature. He died on Jan. 4, 1825.

Ferdinand II (1810-59). King of the Two Sicilies. Born at Palermo, Jan. 12, 1810, he succeeded to the throne at the age of 20, inaugurating his reign with the promise of many reforms. His despotic and cruel nature soon showed itself, however, and before long the kingdom was groaning under oppression and corruption. The insurrections of 1837, 1843, and 1844 culminated in a rising in Sicily and Naples, 1848, which terrified him into granting a constitution. The crushing of Italian hopes after Novara, 1849, encouraged him to annul this, and in order to quell the revolutionary spirit he caused Messina and Palermo to be bombarded, thus earning the nickname of King Bomba. Those who showed liberal tendencies were imprisoned to the number of about 30,000 under



Ferdinand II, King
of the Two Sicilies

conditions which Gladstone, who visited the country in 1851, exposed, describing Ferdinand's rule as the "negation of God." He died May 22, 1859.

Ferdinand (1769-1824). Grand duke of Tuscany. Born May 6, 1769, he was a younger son of the emperor Leopold II. In 1790, when his father became German emperor, he succeeded to the grand duchy of Tuscany. In 1799 he was deposed by the French, in 1802 was made elector of Salzburg, and in 1806 became grand duke of Würzburg. He was restored to his Tuscan throne in 1814, and by his liberal government saved his people from the misfortunes which overtook their neighbours on the restoration of the old monarchies. He died June 18, 1824.

Ferentino (anc. *Ferentinum*). City of Italy, in the prov. of Frosinone. It stands on an eminence at an alt. of 1,290 ft., 48 m. by rly. E.S.E. of Rome. It has extensive remains of the fortifications of the ancient city, including two gateways. It has a fine cathedral with mosaic floors—the aisle was damaged by a shell in the Second Great War—and a few Gothic churches. It trades in oil and wine. Pop. (1951) 16,048.

Ferg, FRANZ DE PAULA (1689-1740). Austrian painter. Born at Vienna, he studied under his father, Pancrazius Ferg, J. Orient, and Jean Graff, and painted landscapes in the manner of Poelenberg and genre in the Flemish style. After some years at the court at Dresden, he visited Brunswick, and then London, where, after enjoying some years of affluence, he died in poverty.

Ferghana. Town of Uzbek S.S.R., capital of a region of the same name. It lies 10 m. S.E. of Marghelan, in the Ferghana valley, and is reached by branch rly. from Andijan or Khokand. Cotton-growing in the region was expanded in the 1930s, and petroleum wells provide the other main industry. The fertile Ferghana valley yields a variety of fruits, nuts, and herbs. Historically, Ferghana has been the name of a province, which was annexed by Russia in 1876. Pop. of town (est.), 35,000.

Fergus. River of Ireland. It rises in the N.W. of co. Clare and flows generally S. for 25 m. to its estuary at Clare village. The estuary, about 10 m. long and 4 m. in extreme breadth, is dotted with islands and contains salmon.

Ferguson, ADAM (1723-1816). Scottish philosopher. Born at Logierait, Perthshire, June 20,

1723, he was educated at Perth and the university of St. Andrews. He became an army chaplain, and was present at Fontenoy with the Black Watch. In 1759 he was chosen professor of natural philosophy at Edinburgh, and retained his post there until 1785, and lived until Feb. 22, 1816. Ferguson is known by his *Essay on the History of Civil Society*, and the belief in progress towards perfection elaborated in his *Institutes of Moral Philosophy*, 1772, and *Principles of Moral and Political Science*, 1792.

Ferguson, JAMES (1710-76). Scottish astronomer. Born April 25, 1710, near Rothiemay, Banff-



James Ferguson,
Scottish astronomer
From a print

shire, he attended Keith grammar school, but at 10 years old he became a farm hand, and looked after sheep, studying the stars at night. He returned home broken in health, but his ingenious construction of a clock attracted the patronage of Sir James Dunbar. In 1734 he went to Edinburgh, where he painted miniatures. In 1743 he removed to London, and was elected F.R.S. in 1763. He became a popular lecturer on experimental science, but was specially noted as an inventor of astronomical and other instruments. He died Nov. 16, 1776.

Ferguson, ROBERT (c. 1637-1714). Scottish conspirator and pamphleteer, known as "the Plotter." Born in Aberdeenshire, he came to England about 1655, and was appointed to the living of Godmersham, Kent, from which he was ejected in 1662 by the Act of Uniformity. He took part in the various plots against Charles II, James II, and William III, but always succeeded in escaping from justice.

Ferguson, SIR SAMUEL (1810-86). An Irish poet and antiquary. Born at Belfast, March 10, 1810, and educated at Trinity College, Dublin, he was called to the Irish bar in 1838. Deputy keeper of the public records of Ireland in 1867, he was knighted in 1878. He died



Sam Ferguson

Aug. 9, 1886. His poems, for the most part metrical versions of Irish legends, comprise *Lays of the Western Gael*, 1865; *Congal*, an epic poem, 1872; and a second volume of lays, *Poems*, 1880. He helped to prepare the way for the Gaelic revival.

Fergusson, JAMES (1808-86). Scottish writer on architecture. Born at Ayr, Jan. 2, 1808, he was educated in Scotland, and became a merchant in India, where he made a study of its architecture, his first book on the subject, *The Rock-cut Temples of India*, being published in 1845. His outstanding work was his *General History of Architecture*, 1865-76; his non-historical works included *The True Principles of Beauty in Art*. He died Jan. 9, 1886.

Fergusson, JOHN MOORE (1863-1944). Scottish divine. A descendant of Sir John Moore, general at Corunna, he was born at Doune, Perthshire, and educated at St. Andrews and Edinburgh universities. Ordained to Rock Ferry, Cheshire, in 1888, he later served at Woolwich, Southend, Wallington, and Dulwich. He was moderator of the general assembly of the Presbyterian church of England, 1932-33. Fergusson was killed in an air raid, July 4, 1944.

Fergusson, ROBERT (1750-74). Scottish poet. Born in Edinburgh, Sept. 5, 1750, he studied at St. Andrews university, and entered the office of the commissary clerk at Edinburgh. In 1771 he began to contribute poems, mostly in the Scottish dialect, for *Ruddiman's Weekly Magazine*, and these appeared in collected form in 1773. He died Oct. 16, 1774. His work greatly influenced Burns, who in 1789 composed the epitaph for the headstone of his grave in Canon-gate churchyard.

Feriae. Sacred festivals or holidays of ancient Rome. The most important were the *Feriae Latinae*, the great Latin festival. During the holding of the *feriae* the city was in charge of special officials and no business was done. See *Festival*.

Ferial and **Festal**. Terms used in music. In the Christian Church *ferial* signifies any day not specially observed either as *festal* or *penitential*, and the music is of a simpler order on *ferial* than on *festal* days.

Feringhi (Pers. *farangi*). Corruption of Frank, the name given by Asiatics to a European. It is now used as a term of contempt.

Fermanagh. Inland county of N. Ireland. The irregular surface is marked by numerous hills, the

highest of which, wholly within the county, is Belmore (1,312 ft.). Lough Erne consists of two lakes—Upper and Lower—respectively about 15 m. in length and 4 m. in breadth, and about 20 m. in length and at widest about 7 m. in breadth. Upper Lough Erne narrows into two channels round the island on which Enniskillen, the county town, is built. Agriculture is the principal industry. Coal,

integers which will satisfy the equation $x^n + y^n = z^n$ where $n > 2$) have led to some of the most fruitful developments in number theory. A councillor for the Toulouse parliament, Fermat died Jan. 12, 1665.

Fermentation (Lat. *fervere*, to boil). Result of the action of organic substances known as ferments. In 1680 the Dutch microscopist Leuwenhoeck showed that yeast consists of definite globules,

ments are nitrogenous organic substances whose activity is destroyed by high temperatures.

The term ferment was at first applied both to the substances which could be extracted from plant and animal material, and which could break down specific compounds, and also to micro-organisms such as yeasts, bacteria, moulds, etc. Nowadays it is rarely used: micro-organisms are spoken of as ferments, but the term *enzymes* denotes the catalytic substances in all living material.

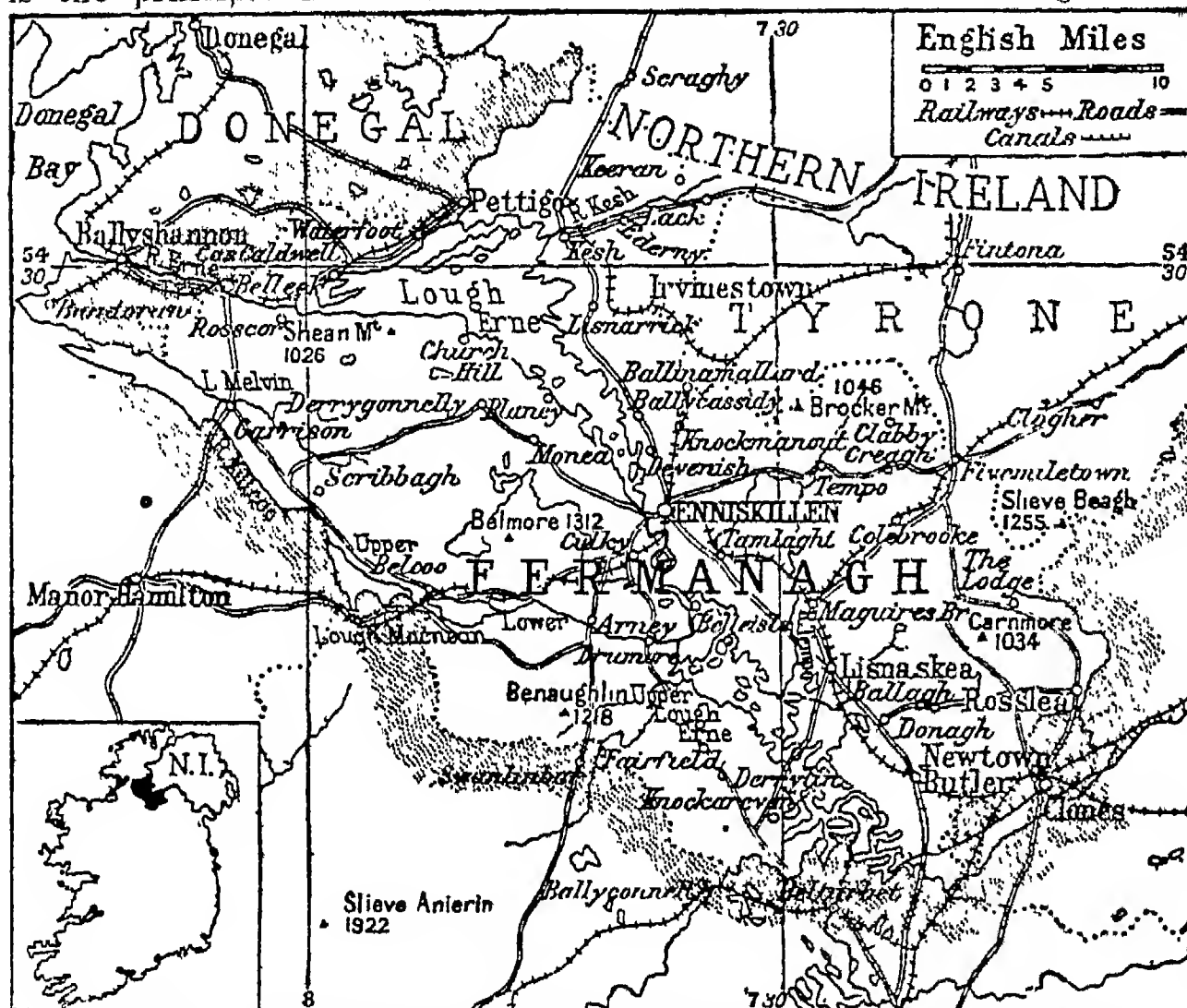
Mucor, Rhizopus, and Penicillium

At one time any fungal growth on organic material was spoken of as a mould, but in later nomenclature the term was restricted to forms such as *Mucor* (the white mould appearing on damp bread) and the closely related *Rhizopus*, distinguished by its black sporangia; also *Penicillium*, the ubiquitous bluish-green mould present on cheese, jam, bread, etc. *Aspergillus* is often associated with it. The red so-called baker's mould is *Neurospora*. (See Mould.)

YEASTS. Also called saccharomycetes because they live mostly in saccharine solutions, converting sugar into alcohol, yeasts form a group of micro-organisms of the greatest importance in fermentation. Yeast cells are round or oval in shape, and multiply by the process known as gemmation or budding, which goes on indefinitely under proper conditions. Otherwise they form spores or new cells liberated by the dissolution of the mother cell.

Although the cells can use oxygen, they appear to be independent of an environment of free oxygen. Time, strength of saccharine solution, and temperature also influence the process of fermentation. The alcohol formed retards the growth of the yeast cell, which ceases to act when above 20 p.c. of alcohol is formed.

Alcoholic or vinous fermentation is the characteristic function of yeasts. Ethyl alcohol (ordinary alcohol) is formed when sugar is fermented. The higher alcohols, propyl, butyl, amyl, and capryl alcohols, are also produced under suitable conditions. Fernbach discovered means of increasing the proportion of amyl alcohol produced during fermentation. Various forms of starch are used as the source of sugar, which is formed by the action of diastase in the process of brewing. Probably all forms are converted into glucose before fermentation proper. (See Alcohol; Rubber.)



Fermanagh. Map of this Northern Ireland county. The inset shows its position in relation to the rest of Ireland.

iron, and building stones are found. Three members are returned to the parliament of N. Ireland, and the co. constituency of Fermanagh and S. Tyrone returns one member to Westminster. Tumuli, raths, castle ruins, and a round tower are among the antiquities. The round tower on Devenish Island in Lough Erne, one of those used as belfries and storehouses for the preservation of monastic treasures during the Danish invasion, with its beautiful carving of the pilaster quoins, retains its original beauty and perfection to a remarkable degree. Area, 653 sq. m. Pop. (1951) 33,040.

Fermat, PIERRE DE (1601–65). French mathematician, born Aug. 17, 1601, near Montauban. He published nothing in his lifetime, but his posthumous notes on Diophantus enunciated a number of propositions about integers which he claimed to have proved. Proofs for all except the last have since been found, and form the foundation of the modern theory of numbers. Attempts to prove the last (that there are no non-zero

but only in 1836 was it settled that yeast cells originated fermentation.

Latour first observed that the cells were living organisms, and his "vital hypothesis," violently opposed by Liebig, was supported by Pasteur, who in 1857 gave it as his opinion that "the chemical action of fermentation is essentially a correlative phenomenon of a vital act, beginning and ending with it. I think that there is never any alcoholic fermentation without there being at the same time organization, development, multiplication of globules, or the continued consecutive life of globules already formed." In fermentation the amount of matter consumed and changed into other compounds is much greater than the size and weight of the organisms responsible. Yeast globules decompose many times their weight of sugar and produce a relatively large quantity of alcohol and carbon dioxide. Experimental work has thoroughly determined the action of ferments, and also that each particular organism has its special products of fermentation. All fer-

The chief yeasts are: (1) *Saccharomyces cerevisiae*, the ordinary yeast of the brewer and distiller. Two kinds are recognized, "top" and "bottom" yeast, the former rising to the top of the liquid during fermentation and the latter forming a sediment in the vats. Top yeast is used in English ale fermentation, bottom yeast producing the lighter lager beer.

(2) *Saccharomyces ellipsoideus* is the ordinary ferment of vinous fermentation by which "must" or grape juice is converted into wine. (3) *Saccharomyces pastorianus* also occurs in wine-making, and when present during brewing gives a bitter taste to the beer. (4) *Saccharomyces mycoderma* is the cause of "mother" which appears on the surface of wine or beer after exposure for some days to the air.

Hansen, the Danish brewing chemist, isolated and cultivated the two pure yeasts, varieties of *Saccharomyces cerevisiae*, by using which it is possible to obtain beers of distinctive properties.

ACETIC FERMENTATION. It has long been known that when wine is exposed to the air it sours—turns into vinegar—and the manufacture of vinegarwort is an old-established art. It is essentially an oxidation process, and Pasteur first detected the organism, "flowers of vinegar," *Bacillus aceti*, which effects the change. Hansen detected two distinct species with the same properties. Both require oxygen for their growth, most favoured by a temperature of 33° C.

Lactic fermentation produces sour milk. The milk sugar is first split up into lacto-glucose and then into lactic acid by the agency of *Bacillus acidi lactici*. A special bacillus, named *Bacillus caucasicum*, was found by Metchnikoff to be present in the soured milk called "yoghourt."

Viscous fermentation, due to *Pediococcus cerevisiae*, is the cause of "ropiness" in brewing, and a similar condition in bread-making.

Nitrification in Agriculture

Nitrification or the oxidation of ammonia into nitrous and nitric acids takes place through the agency of bacteria. Warington's investigations at Rothamsted showed the importance of nitrification in agriculture. Special preparations of nitrification bacteria are used commercially to promote the growth of leguminous plants.

ENZYMES. These organic catalysts may be defined as substances produced by living organisms, which initiate or hasten reactions

between organic and inorganic compounds. They are classified according to the class of compounds on which they have effect.

Esterases act on carbohydrates and include those acting on complex molecules such as starch, i.e. diastase (almost universally distributed in animals and plants) and cellulose, i.e. cellulases and cytases. True cellulases are found only in a few fungi and bacteria, but cytases occur in most fungi and also in the seeds of many flowering plants and conifers. The commonest enzymes acting on sugars, and thus producing glucose, are invertase and maltase, both widely distributed in plants and animals.

Lipases act on fats, converting them into fatty acids and glycerin. The best known is lipase, which is found in the pancreatic juice of mammals and in various plant tissues.

Enzymes affecting proteins are known as *proteolases* and include the coagulating enzymes found in blood and proteolytic enzymes such as pepsin and trypsin (found in animal digestive juices), papain from *Carica papaya*, and a number of enzymes from plant tissues. Proteolytic enzymes assist in the breakdown of proteins into peptones and peptides, and finally into amino-acids.

Zymase, from yeast, is a battery of enzymes acting on a variety of compounds.

Enzymes in Industry

Enzymes play a part in such industries as brewing and leather making. In the preparation of rubber, the drying of tea, and the curing of tobacco the proper treatment of the vegetable enzymes contained in these substances determines the quality of the products. In drying drugs the activity often depends upon the prompt killing by heat of the enzymes in the plants. Special processes have been evolved in which the vapour of boiling alcohol is employed for this purpose.

PUTREFACTION. This is the process of breaking down nitrogenous organic matter, especially proteins, accompanied by the production of evil-smelling gases. The process is due to micro-organisms, the decomposing substances yielding, among other organic bases, methylamine, tri-methylamine, and the important bodies known as ptomaines. Many ptomaines are very poisonous. Produced readily in decaying meat and fish, when introduced into the human body they give rise to serious blood poisoning.

See Brewing; Distilling; Enzyme; Liebig; Pasteur; Yeast.

Fermi, ENRICO (b. 1901). Italian physicist. Born at Rome, Sept. 29, 1901, he was educated at Göttingen and Leyden universities, and was appointed to the chair of physics at Florence, 1924, and Rome, 1926. In 1934 he succeeded in breaking heavy uranium atoms into the comparatively small atoms of lanthanum. At the time, however, Fermi imagined that he had merely repeated Rutherford's experiment of chipping small pieces off the atomic nuclei. In 1938 he was awarded the Nobel prize for physics and in 1942 received the Hughes medal of the Royal Society for his research in artificial radio-active substances. Some time before the Second Great War, he went to live in the U.S.A., where he ultimately joined the team of scientists responsible for the atomic bomb.

Fermo (anc. *Firmum Picenum*). City of Italy, in the prov. of Ascoli Piceno. It stands on an eminence, rather more than 1,000 ft. high, 4 m. from the Adriatic and 36 m. by rly. S.S.E. of Ancona. Enclosed by battlemented walls, it contains a 13th century cathedral, a town hall, and library, besides remains of Roman buildings. Porto San Giorgio, its port, exports grain, wool, and silk. Fermo was founded by the Romans in 264 B.C. and was a free city from 1199 to 1550, when it fell to the papacy. Pop. (1951) 27,714.

Fermoy. Urban dist. and market town of co. Cork, Irish Republic, on the Blackwater, 21 m. N.E. of Cork by the state rly. Its importance is chiefly due to the efforts of John Anderson, a Cork merchant, who began to build here in 1791, and later gave a site for the erection of military barracks and founded Fermoy college. The town contains a Roman Catholic cathedral and S. Colman's Roman Catholic college. Salmon and trout fishing is plentiful and a trade in flour is carried on. There are a racecourse and a golf course in the vicinity. Fermoy was the scene of rioting on June 28-29, 1920, when the military wrecked a number of buildings as reprisal for the capture of General Lucas. Market day, Sat. Pop. (1951) 4,014.

Fern (*Pteridophyta*). A member of the largest and most highly developed group of flowerless plants (Cryptogamia). The Pteridophyta include, besides ferns, horsetails, club mosses, and a number of fossil plants. Most are perennial herbs, a few being

shrubby and tree-like, and all possess a well-developed vascular system often of a most complicated net-like nature.

The life history of the Pteridophyta is an example of the so-called alternation of generations in which there are two distinct types of plant, one bearing the sexual organs and the other sporangia. Spores from the latter develop into plants bearing sexual organs whilst the products of sexual fusion develop into spore-bearing plants. The conspicuous fern plant bears on the backs of its leaves small brown patches which consist of innumerable sporangia. When mature these dehisce and scatter hundreds of microscopic spores into the air. If these land on suitably damp soil the spores germinate into small scale-like bodies known as prothallia. The latter bear the sexual organs (archegonia and antheridia) on the under surface. When ripe the archegonia extrude an attractive substance towards which the male elements from the antheridia swim. One male element (spermatozoid) enters each archegonium and fuses with the egg within. The resultant embryo develops a root and leaves and assumes the familiar fernlike appearance.

From the gardener's point of view hardy ferns are valuable to fill moist, shady places for which the choice of flowering plants is limited, but the use of exotic ferns, except as specimens, or in elaborate winter gardens, has fallen into disuse, since some consider that space can be employed to greater advantage by flowering plants. This is purely a matter of taste; the beauty of the fern is lasting, that of the flower ephemeral.

Suitable Soil and Situation

Hardy ferns are not particular as to soil, though to obtain the best results a mixture which contains a considerable percentage of decayed leaf-mould or peat is desirable, or, failing this, some old stable manure should be mixed with the loam when making up the bed. The situation is more important; the north side of a wall or hedge, where less hardy things are difficult to grow, will suit ferns admirably. It is well not to plant them too near ivy, however, as this climber is so greedy a feeder that it speedily takes all the nourishment away from the ferns, especially if they are of choice kinds. The ordinary brake fern, or bracken, will grow anywhere, but except for very smoky and shady town gardens, its employment in

any quantity is not recommended as it is a greedy feeder.

Exotic ferns should be taken in hand in early spring, when the new growth starts. They will thrive in any ordinary potting mixture, one which contains a liberal admixture of silver sand for preference, and they may be shifted into larger pots when necessary, at any time of the year except winter. Ferns are most easily increased from spores, which are found upon the undersides of the leaves. When these are ripe the most fruitful leaf or leaves should be severed from the parent fern, and stored away in a box or piece of paper for a few days, and kept dry until the spore cases burst. The spores should then be lightly sown upon the surface of a box of finely sifted potting soil, and kept moist. Tiny ferns will appear, developing from prothallia, and these should be very carefully potted into thumb-pots when large enough to handle, and afterwards repotted as desired.

Maidenhair and Ribbon Ferns

When ferns such as the maidenhair, ribbon-fern, or any of the native species have been grown in the greenhouse, it will be found that the top-soil of the pots is already sown with their spores. If this is removed to a shallow pan and covered with glass, it will soon be covered with prothallia.

Gold and silver ferns are popular names given to several species to denote their appearance. It is due to the under surface of the leaves being coated with fine particles of white or yellow wax. Examples of silver ferns are *Cheilanthes argentea* (Asia), *Ceropteris chrysophylla* (tropics), *Ceropteris decomposita* (S. America).

Fernandel. Professional name of Fernand Joseph Désiré Constandin (b. 1903), French actor. Born in Marseilles May 8, 1903, he tried 14 ways of earning a living before in 1928 he made a successful appearance at a Paris music hall. His playing in a revue, *Vive le Nu*, in 1930 attracted the attention of Sacha Guitry who engaged him for his film *Le Blanc et le Noir*.

Fernandel's meridional accent, smiling, ugly yet *sympathique* face, and gift for broad farce,

brought him immense success as a film actor. He played in several of Pagnol's outstanding productions: e.g. *Angèle*, 1934; *Regain*, 1937; *Un Carnet de bal*, 1938; *La Fille du Puisatier*, 1940. Later notable appearances were in *L'Auberge rouge*, 1951; *Le Petit Monde de don Camillo*, 1952, and its sequel, *Le Retour de don Camillo*, 1953; and *Le Mouton à cinq pattes*, 1954, in which he brought his film appearances up to 150 by playing an old man of a Provençal village and all his quintuplet sons.

Fernandez, Juan (c. 1536-1602). Spanish navigator. A native of Cartagena, Fernandez spent his life as a pilot on the Pacific coast. In c. 1565, he discovered the island now called by his name, on which he vainly tried to settle some Indians. His skill as a sailor won him the nickname of the wizard, and also brought him to the notice of the Inquisition. See Juan Fernandez.

Fernando de Noronha. Island of Brazil, constituted a territory 1942. It is about 200 m. E.N.E. of Cape St. Roque, 8 m. long by 1½ m. wide, is of volcanic origin, reaching an elevation of 1,100 ft., and has several good harbours protected by forts. The surface is rugged, but fertile, producing cereals, cotton, and fruit. At Remedios is a convict settlement, with a cable and wireless telegraph station. The island was discovered by a Portuguese navigator, whose name it bears. It is an air staging point. Area 10 sq. m. Pop. (1950) 581.

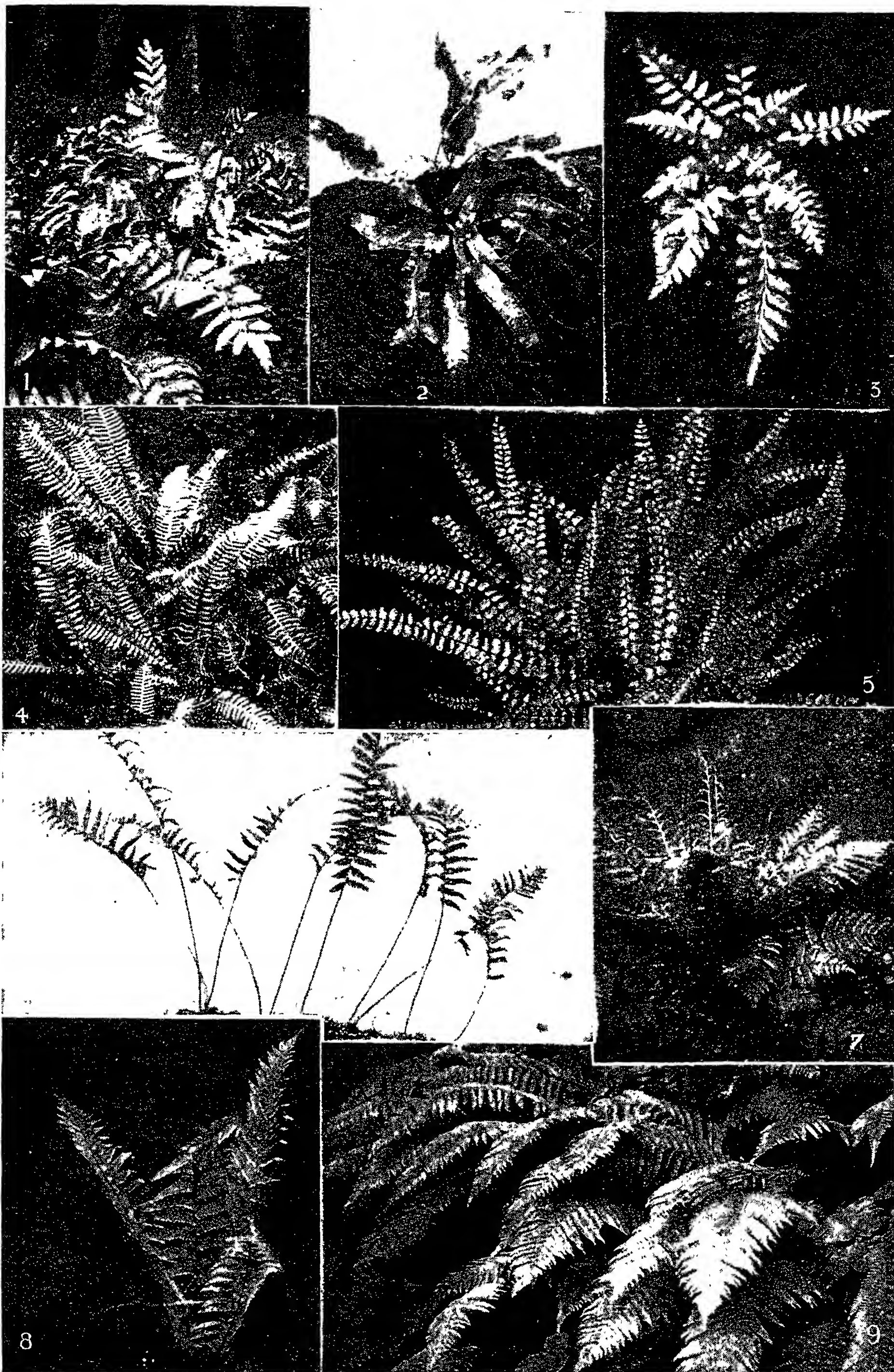
Fernando Po. Island in the Bight of Biafra, belonging to Spain. The key to this portion of the African coast, it is mountainous and fertile. Of volcanic origin, it is 35 m. long and 22 m. broad. Densely forested and covered with luxuriant vegetation, it yields sugar-cane, bananas, and yams, while cotton, coffee, rice, tobacco, and cinchona are cultivated. The highest mt., Clarence Peak, is 10,190 ft. The island is inhabited by a Bantu tribe, the Rubis, and a few Negroes.

Santa Isabel, the chief town, is the administrative capital of the Spanish possessions in the Bight of Biafra. Rubber and palm oil are exported. The climate is unhealthy. The island is named after Fernão do Po, its Portuguese discoverer in 1471. It was ceded to Spain in 1778. Area 800 sq. m. Pop. (1950) 40,475.

Ferney-Voltaire. A small town of France, in the dept. of



Fernandel,
French actor



1. Royal fern, *Osmunda regalis*. 2. Hart's-tongue, *Scolopendrium vulgaris*. 3. Sea spleenwort, *Asplenium marinum*. 4. Hard fern, *Blechnum spicant*. 5. Maidenhair spleenwort, *Asplenium trichomanes*. 6. Common polypody, *Polypodium vulgare*. 7. Lady fern, *Athyrium filix-foemina*. 8. Male fern, *Dryopteris filix-mas*. 9. Prickly shield fern, *Athyrium aculeatum*.

FERN: SPECIES FOUND IN THE BRITISH COUNTRYSIDE

Ain. It stands near the Swiss frontier, and for that reason was chosen by Voltaire as the site of a château he built and lived in 1758-78; this contains numerous memorials and personal relics of the philosopher, who in 1768 founded a watch factory, which at one time employed 800 hands. In the town hall is a statue to Voltaire, whose name was included in that of the town in 1878. Pop. (1954) 1,278.

Fernie. City of Canada, in extreme S.E. of British Columbia. It lies 650 m. E. of Vancouver on the C.P.R., is on the Elk river, and is a tourist centre for the Kootenays. Coalmining is carried on, and the city owns its light, power, and water systems. Pop. (1951) 2,551.

Fern Owl. This bird is more commonly called the nightjar (*q.v.*).

Fern Palm (*Cycas revoluta*). Tree-like perennial of the family Cycadaceae. A native of China, it has a stout stem, in old individuals as much as 7 ft. high, crowned by the arching, palm-like leaves. These are cut into narrow segments in a feather-like manner, and vary in length from 2 ft. to 6 ft. The reproductive organs are found in the heart of the leaf-crown: the males in cones, whose scales bear anthers on their under surface; the females bearing ovules in the marginal notches of woolly, leaf-like organs.

Ferns. Town of the Irish Republic, in co. Wexford, on the Bann, 74 m. S. of Dublin. It is the seat of R.C. and Protestant bishoprics. Buildings of interest are the two cathedrals, the episcopal palace, ruins of a Norman castle, of a church, and a monastery. The town grew up around a monastery founded by S. Edan about 600. The kings of Leinster had a palace here. The Protestant diocese was united with Ossory in 1836. James I gave Ferns a charter, and until 1800 it sent two members to the Irish parliament.

Ferozepore OR FEROZAPUR. District and town of Punjab, India. The dist. has no important manufactures; wheat, gram, barley, and millet are the chief crops. Half the cultivated area is artificially irrigated. Area 4,085 sq. m. Pop. (1951) 1,326,520.

Ferozepore town, 4 m. S.E. of the Sutlej river, is served by the Northern Rly. Founded in the 14th century, it is a centre of the grain trade. Battlefields of the Sikh War, 1845-46, lie to the E. Pop. (1951) 40,703. Pop. of Ferozepore cantonment, 38,784.

Ferozeshah, BATTLE OF. British victory in the first Sikh War. On Dec. 21, 1845, Sir Hugh Gough, who had just won the victory of Moodka, advanced against the Sikhs, and after a violent cannonade attacked with his infantry. The first British attack was repulsed with heavy loss. In the second effort the Sikhs were routed, losing 73 guns. See Sikh Wars.

Ferragus, FERRACUTE, FERRAUTE, OR VERNAGU. Giant of early French romances. In the Charlemagne legends he overcomes all that monarch's paladins except Roland, by whom he is slain. In Ariosto's Orlando Furioso he is a Saracen who throws away his helmet, declaring that he will never wear another until he has won that of Orlando, by whom he is killed.

Ferranti, SEBASTIAN ZIANI DE (1864-1930). A British scientist, born at Liverpool, April 9, 1864. He devoted his life to the improvement of existing methods of supplying and measuring electrical power. In 1882 he patented the Ferranti alternator, and then invented the electrical meter bearing his name. The Ferranti meter consists of an electro-magnet containing a thin disk of mercury, and the rotation of the disk serves as a measure of the strength of the current passing through the meter (see Meter, Electrical). In 1886 he set up his own generating station in Liverpool, and in 1892 founded the Ferranti electrical engineering works at Hollinwood, Lancs. He was president of the Institute of Electrical Engineers, 1910-11, and was elected F.R.S. in 1927. He died Jan. 13, 1930.

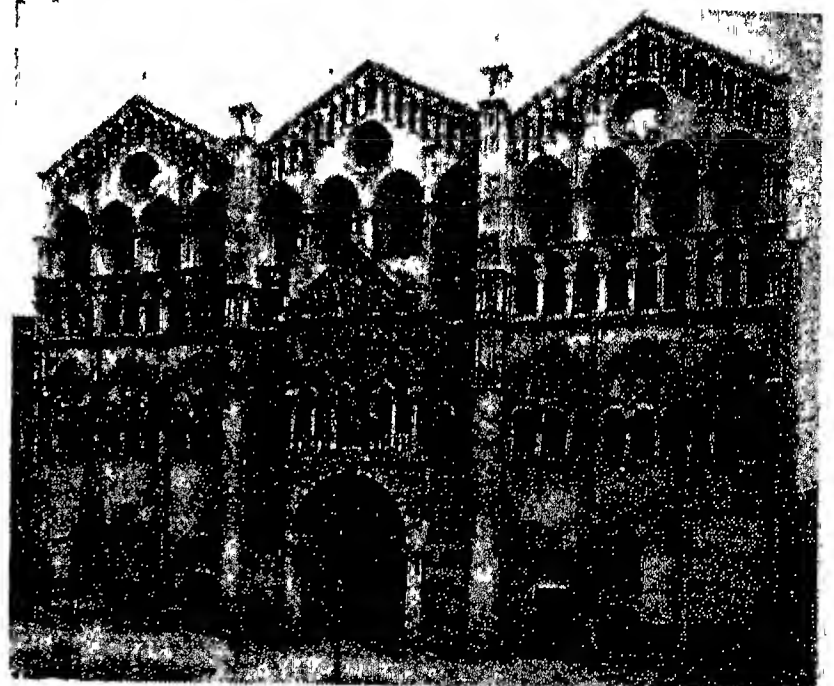
Ferrar, NICHOLAS (1592-1637). English theologian and founder of the Little Gidding community. Son of a London merchant, he was educated at Clare Hall, Cambridge, and worked for the Virginia Company, 1619-23. He was elected to parliament, but in 1625 retired, with his mother and brother-in-law, Collet, and their families, to the manor of Little Gidding, Hunts, to a secluded life of devotion, study, and good works. In 1626 he was ordained deacon by Laud. He died Dec. 4, 1637.

The members of Little Gidding household were famed for their skill in embroidery, bookbinding,

and "scrap book" making, and examples survive in the British Museum and elsewhere of cunningly constructed "harmonies," or "concordances" of the Bible, illustrated with prints collected by Ferrar on his travels. The "Arminian Nunnery" was twice visited by Charles I, and was broken up by the Puritans in 1647; it figures in J. H. Shorthouse's John Inglesant, and in Izaak Walton's Life of George Herbert.

Ferrar, ROBERT (1500-55). English martyr. He studied at Oxford and later was head of a religious house in Yorkshire, but became prominent on the accession of Edward VI. Owing to the influence of Somerset he was made bishop of St. Davids. He was a zealous reformer, but charges were brought against him, and, Somerset having fallen from power, he was imprisoned in 1552. In 1554 his bishopric was taken from him, and he was put on his trial. Found guilty, he was burned at Carmarthen, March 30, 1555. The chief charge against him was that he had violated his vow of chastity by marrying.

Ferrara. Prov. of N.E. Italy. It is bounded N. by the river Po and E. by the Adriatic Sea. Area,



Ferrara. Façade of the cathedral of S. George, the lower part dating from 1135

1,019 sq. m. Low-lying and marshy in parts, it lies mostly within the delta formed by the Po and its branches and by the Primaro and the Panaro, and embraces the lagoons of Comacchio (*q.v.*). It was the scene of bitter fighting in April, 1945. Fairly fertile, it produces rice, grain, wine, hemp, silk, salt, and fish. The capital is Ferrara. Pop. (1951) 415,873.

Ferrara. City of Italy, capital of the prov. of Ferrara. It stands about 3 m. S. of the river Po di Volano, 30 m. by rly, N.N.E. of Bologna. An archiepiscopal see, its cathedral dates from the early 12th century. The city is

surrounded by crumbling walls, but its palaces and other structures attest its former splendour. Several churches and palaces were damaged during the Second Great War. Ferrara was the seat of the court of the family of Este (*q.v.*), and their castle (now utilised as public offices) was a moated fortress with four towers. The university was founded in 1391, and its library is rich in MSS. of Tasso, etc. Among other buildings are a picture gallery, and the houses of Ariosto and Guarini.

From the 14th to the 17th century Ferrara was a prosperous city, and in the 15th was noted for its school of painting. It has a considerable trade in hemp, soap, wax, candles, glass, and silk. Guarini and Savonarola were natives. It came into the possession of the Este family in 1146, and was their capital until 1598, when it passed to the papacy. In the papal interest its fortress was garrisoned by the Austrians during the revolutionary times of 1832–59, after which the city joined the kingdom of Italy. In the Second Great War Ferrara was liberated from the Germans, April 24, 1945. Pop. (1951) 134,719.

Ferrara, ANDREA. Italian sword-maker of the 16th century. He was working in Belluno in 1585, and swords bearing his name were used in Scotland in the 16th and 17th centuries. The steel was tempered by a process claimed to be that invented by the swordsmiths of Damascus. The name Andrea Ferrara was afterwards employed rather as a trademark than as implying any connexion with the original maker.

Ferrara-Florence, COUNCIL OF The oecumenical council of the Church held at Ferrara, and later at Florence, between April, 1438, and July, 1439. It was called by Pope Eugenius IV as a continuation of the council of Basel, and had as its main object the healing of the breach between the Roman and Greek churches. The Latin emperor, John Palaeologus, representing the Greeks, brought a large delegation at the pope's invitation to Ferrara. The scene of the council was changed to Florence in January, 1439. The debates turned chiefly on the Filioque controversy, *i.e.* the question whether the Holy Ghost proceeds from the Father and Son (*ex Patre Filioque*), or from the Father alone. On July 6 a decree was published which declared that, while the pope was the supreme head of all the Church,

the rights of the Eastern patriarchs were to be unaffected.

The two churches were thus momentarily united in intention, but not in effect. Isidore of Kiev was sent as legate to Constantinople by Pope Nicholas V in 1452, in order to push the process of union forward, but before he had accomplished his mission the city was taken by the Turks, 1453. This undid the work of the council, the last effort at Eastern and Western reunion.

Ferreira, ANTONIO (1528–69). Portuguese poet. Born in Lisbon, he was educated at Coimbra university. Famous as one of the earliest and the most distinguished of those who introduced the classical mode into Portuguese literature, he used the Italian decasyllable in his sonnets, substituting a measured austerity for the formless verse of his predecessors. His great work, the *Castro*, was the first verse tragedy written in Portuguese, and one of the earliest in modern European literature. He died Nov. 29, 1569.

Ferrel, WILLIAM (1817–91). American meteorologist. Born in Bedford co., Pa., he early turned his attention to meteorology, then a neglected science, and his researches soon won him world-wide fame. In 1867 he became a member of the U.S. coast and geodetic survey, and began to formulate the laws of meteorology on a scientific basis. His invention of a tide-predicting machine came into general use in the U.S. government coast surveys. He wrote *Tidal Researches*, 1874; *Meteorological Researches*, 1877–82; and *Popular Treatise on the Winds*, 2nd ed. 1898.

Ferrel's Law. Law of the deflection of bodies moving in the air of the rotating globe. If a body moves in any direction except E. or W. on the earth's surface the rotation of the earth will cause it to be deflected to the right of the direction of movement in the N. hemisphere, and to the left in the S. hemisphere. The law is an example of the general case in mechanics when a body acted upon by two forces moves in a direction compounded of the original directions of the forces. In the N. hemisphere a body forced northwards receives an eastward impulse from the earth's rotation, and moves towards the N.E.

Ferrer, FRANCISCO (1859–1909). Spanish revolutionary. Born near Barcelona, he was a railwayman,

1877–85, and studied socialism and rationalism. He was closely associated with the republican agitator Zorrilla, with whom he lived in Paris. Ferrer returned to Barcelona in 1901, and was prominent in founding lay schools and centres of advanced socialist and rationalist teaching. In 1907 he was acquitted of having taken part in the attempt to assassinate the king in 1906. In July, 1909, he was active in the insurrections in Barcelona, aiming at the establishment of a new anti-Catholic state in Catalonia. Condemned as the prime instigator, he was shot on Oct. 13, his execution raising much indignation, mainly against Roman Catholic influence in Spanish politics.

Ferrero, GUGLIELMO (1871–1942). An Italian historian and sociologist. Born at Portici, near Naples, July 21, 1871, he made his reputation as a historian with *L'Europa Giovane*, 1897. Professor of history at Rome, he moved to Geneva in 1930, and held the chair of modern history at the university there. A profound thinker, he was chiefly concerned in his later works with diagnosing the crisis in western civilization. His most important works included *History of the Roman Republic*, published 1902–09, and translated into almost every European language; *Tra i Due Mondi*, 1913; *Adventure*, 1936; *Reconstruction*, 1940; *Pouvoir: Les Génies Invisibles de la Cité*, 1942. He died Aug. 3, 1942.

Ferrers, EARL. British title borne since 1711 by the family of Shirley. The family of Ferrers first appeared in England with William the Conqueror. Henry Ferrers was a great landholder, especially in the North Midland counties, and his son Robert was made earl of Derby in 1138. His successors, who had Tutbury Castle for their main stronghold, were known as earls Ferrers or earls of Derby. John, son of the 6th earl, was summoned to parliament in 1299 as Baron Ferrers of Chastley. This title passed to the family of Devereux in 1461 and remained therein until 1646, when it fell into abeyance.

The Shirleys became connected with the title through the marriage of Sir Henry Shirley with the daughter of Robert Devereux, 2nd earl of Essex. In 1677 Sir Robert, a descendant of Sir Henry, was allowed to assume the baronial title, and in 1711 he was made Viscount Tamworth and Earl Ferrers. Laurence, the 4th

earl (1720-60), was the last peer in England to be executed as a felon. In 1745 he succeeded to the title on the death of his uncle. In a moment of anger he shot his steward, Johnson, and was tried for murder by his peers in Westminster Hall. Found guilty, he was hanged at Tyburn, May 5, 1760. An eldest son is called Viscount Tamworth.

Robert (1894-1954), the 12th earl, was a practising architect of some note.

Ferrers, GEORGE (c. 1500-79). English politician and poet. He was page of the chamber to Henry VIII, who took him with him in the Scottish and French wars and bequeathed him 100 marks. He is mainly remarkable for having produced and probably written masques for Edward VI's Christmas entertainments in 1551-52 and for having contributed several tragical episodes to Baldwin's *Mirror for Magistrates*, 1559-78.

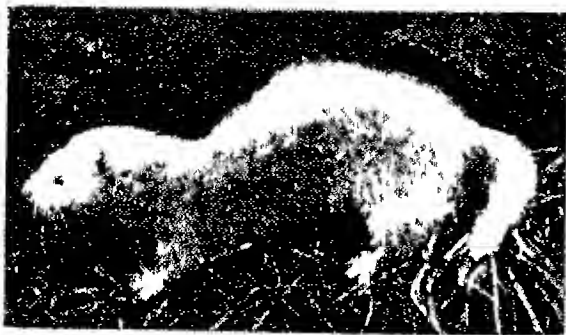
Ferret (*Putorius*). Domesticated variety of the polecat, kept for hunting rabbits. According to Roman writers the polecat came from Africa, and although it is now quite unknown there, it is probable that it was originally domesticated in N. Africa or Spain, and afterwards introduced into Italy. As a result of domestication, the polecat became smaller and slimmer, and albinos became the rule instead of the exception. In this way the ferret developed. It is a somewhat delicate animal, and its intolerance of cold suggests its Mediterranean origin. It breeds readily with the wild polecat, and the brownish variety known as the polecat-ferret is probably the result of such crosses. The ferret is only semi-domesticated. It has no affection for its owner, is very ferocious, and is as likely to bite the hand that feeds it as any other. It therefore needs to be handled with caution, the best way being to grasp it close behind the shoulders.

The method of hunting a rabbit warren with ferrets is to net or stop all the holes except one, at which the ferret is inserted. The rabbits, finding an inveterate enemy on their track, bolt for the holes and are thus caught in the nets. It is a common practice to muzzle the ferret; otherwise, if it catches a rabbit in the burrow, it will remain there to make a meal of it.

Ferrets need great care to keep them in good health, warmth and scrupulous cleanliness being the chief essentials. Plenty of warm litter must be provided, and the hutch should be thoroughly cleaned and disinfected at least once a week. The food should consist of fresh bread and milk, and a little raw meat may be given once a week. Ferrets breed freely in captivity and usually rear two families in the year. See Rabbit.

Ferrex and Porrex. One of the titles under which the earliest extant English tragedy is known. See Gorboduc.

Ferric Salts. Iron forms, with acids, two series of salts, ferrous and ferric. The ferric salts are generally yellowish or reddish brown in colour, and are reduced to the ferrous state by means of zinc. Ferric chloride (FeCl_3) is prepared in the anhydrous state by heating iron wire in a current of dry chlorine gas, and in the form of solution by dissolving iron wire in hydrochloric acid and then passing chlorine into the liquid until it smells of the gas.



Ferret. The domesticated polecat which is used for rabbiting

As a tincture ("steel drops") ferric chloride is used in medicine as a tonic. With a soluble thiocyanate, ferric chloride gives an intense blood-red colour. Ferric sulphate, $\text{Fe}_2(\text{SO}_4)_3$, obtained by oxidising ferrous sulphate by means of nitric acid, is used in combination with logwood to dye cotton black. Iron alum is a compound of ferric sulphate and potassium sulphate. This and ferric nitrate are used in dyeing. Ferric oxide, which occurs naturally and is also produced by distilling ferrous sulphate, is known as red ochre and colcothar, and used as colouring matter and polishing material.

Ferricyanides. Salts of ferricyanhydric acid, $\text{H}_3\text{Fe}(\text{CN})_6$, first made by Gmelin by decomposing lead ferricyanide with dilute sulphuric acid and evaporating the solution after filtration. Potassium ferricyanide or red prussiate of potash is prepared by passing chlorine through a solution of potassium ferrocyanide or over the dry salt until it no longer gives a blue colour with a ferric salt.

The salt is in deep red crystals and forms with water a dark yellow solution which darkens with age and becomes converted into ferrocyanide. On adding ferrous sul-

phate (green vitriol) to potassium ferricyanide solution a blue precipitate known as Turnbull's blue is obtained. When chlorine is passed into a solution of potassium ferricyanide a green precipitate known as Prussian green is formed, the appearance of which is the indication that the end of the process has been reached. Potassium ferricyanide, a powerful oxidising agent, when employed with caustic potash, is used in the preparation of ferro-prussiate paper upon which "blue prints" are made. See Colour Printing.

Ferrier, JAMES FREDERICK (1808-64). Scottish metaphysician. Born at Edinburgh, June 16, 1808, he was professor of moral philosophy and political economy at St. Andrews from 1845 until his death, June 11, 1864. Like Berkeley, he is an idealist and immaterialist. There is no such thing, he believes, as independent matter; all external things exist only subjectively; the only material world which really exists is one with which intelligence co-exists. The conscious subject is inseparably connected with the conceived object. At the same time, he does not deny the existence of the real material world *per se*, as distinct from that known to us through the subjective medium of space and time, but declares it to be simply unknowable. His most important work is *Institutes of Metaphysics*, 1854.

Ferrier, PAUL (1843-1920). French dramatist. Born at Montpellier, he studied for the bar, but turned to playwriting after the production of his first piece, a verse play, *La Revanche d'Iris*, in 1868. He wrote and collaborated in a large number of opera libretti, comic operas, and comedies, well known in France for their gaiety and humour. Among the most successful were *Les Mousquetaires au Couvent*, 1880; *Tabarin*, 1884; *L'Article 231*, 1891; *La Belle Mère*, 1898. He died Sept. 11, 1920. Pron. Ferry-ay.

Ferrier, SUSAN EDMONSTONE (1782-1854). Scottish novelist. Born at Edinburgh, Sept. 7, 1782, she published her first novel, *Marriage*, in 1818, followed by *The Inheritance*, 1824, and *Destiny*, 1831. Published anonymously they gave a shrewdly satirical



Susan Ferrier

picture of contemporary Scottish society, and won great popularity and the praise of critics as eminent as James Hogg and Scott. She was known familiarly as Scott's "sister-shadow," and died at Edinburgh, Nov. 5, 1854. Her *Recollections of Visits to Ashestiel and Abbotsford* were published in 1881.

Ferrite. In metallurgy, the form of iron which is stable at temperatures below 900°C . Above this temperature iron containing only small amounts of carbon is in the form of a solid solution of carbon in gamma-iron. This is called austenite and has a face-centred cubic crystal lattice. At 900°C . it transforms to alpha-iron or ferrite, which has a body-centred cubic lattice and will hardly dissolve any carbon at all. The excess carbon dissolves in the remaining gamma-iron and a typical eutectoid (*q.v.*) is formed, known as pearlite. Ferrite is feebly magnetic above 780°C ., strongly so below this point. By itself ferrite is not very strong and steels made from it are alloyed, *e.g.* with cementite.

Ferro. See Hierro.

Ferro-Alloys. Series of alloys of iron with high proportions of manganese, chromium, vanadium, silicon, molybdenum, tungsten, or similar element. They are widely used in steel making, being the most convenient form in which to add the various alloys used for deoxidising and alloying. With between 10 and 90 p.c. of the alloying element, they have a hard brittle character. Ferro-manganese is still made in the blast furnace much as pig iron is. Ferro-silicon and ferro-chrome are made more cheaply and with lower carbon content in the electric arc furnace. For ferro-silicon the furnace is fully charged with iron ore or scrap iron and quartzite and melted gradually away from the electrodes by the great local heat generated by the arc. The use of the electric furnace has contributed to the development of alloy steels.

Ferro-Concrete. Material used in building. It is described under Concrete. See also Building.

Ferrocyanides. Salts of ferrocyanic acid, $\text{H}_4\text{Fe}(\text{CN})_6$. Most ferrocyanides are coloured, and those of the soluble alkalis are non-poisonous, although from them hydrocyanic or prussic acid can be readily prepared. The most important of these salts is potassium ferrocyanide or yellow prussiate of potash. The old process of manufacture consisted in fusing together potassium carbonate with iron borings and

nitrogenous animal matter such as leather cuttings or woollen rags, and lixiviating the mass with water. Potassium ferrocyanide is a by-product of the manufacture of coal-gas. It is used in producing Prussian blue (ferric ferrocyanide) and other cyanogen compounds in calico-printing, and for case-hardening iron.

Ferrol. Seaport of Spain, in the prov. of Corunna. It stands on the N. arm of the Bay of Betanzos, and is the chief Spanish naval station on the Atlantic. The harbour is sheltered and commodious, with shipbuilding yards, docks, and quays, defended by both nature and art. It has a first-class arsenal, a naval academy, and many fine public buildings. It manufactures naval stores, leather, sailcloth, cotton and linen. The British besieged it in 1799, and took it in 1805. It was captured by the French after six weeks' blockade in 1823. Pop. (1950) 77,030.

Ferromagnetism. See under Magnetism.

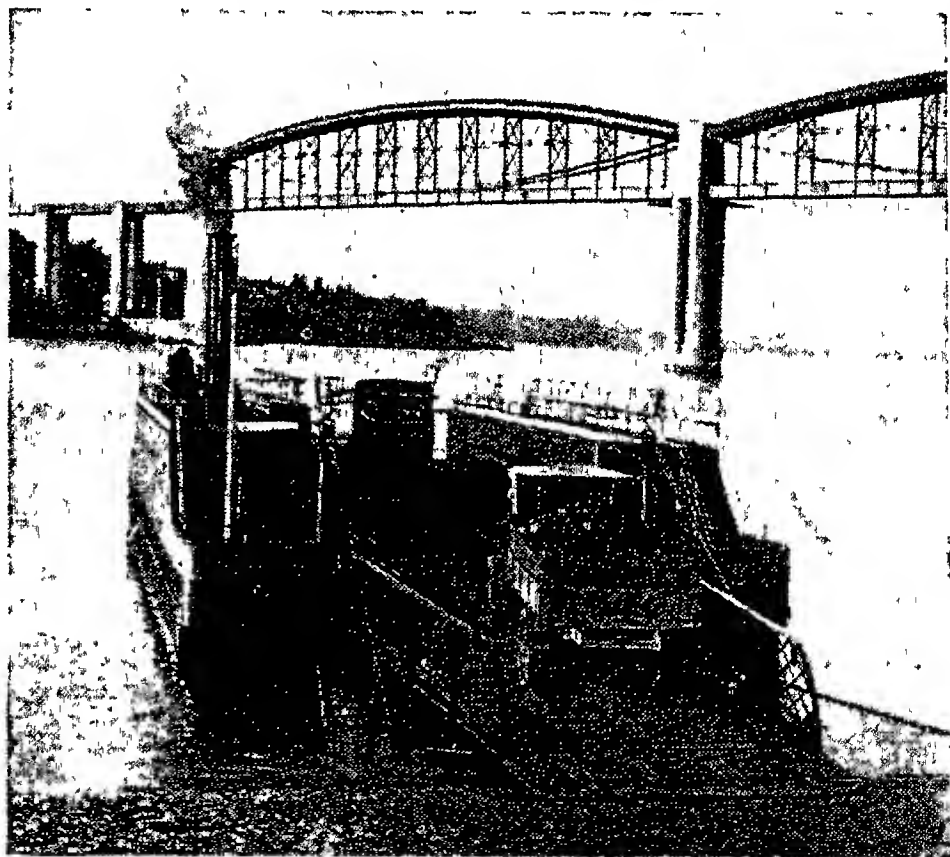
Ferrous Salts. Group of iron salts. Ferrous sulphate, $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, green vitriol, or copperas, is obtained in large quantities by exposing the pyrites occurring in coal-measures to the atmosphere. The soluble ferrous sulphate together with the excess of sulphuric acid, runs into underground tanks where the excess of acid is removed by means of scrap iron. The liquid, on evaporation, yields crystals of ferrous sulphate.

Ferrous sulphate is used in the manufacture of ink, in dyeing and tanning, and in the preparation of Prussian blue. The pure salt is used in medicine. Ferrous oxide, FeO , has the property, when freshly made, of oxidising with incandescence on exposure to the air. Ferrous iodide, FeI_2 , is used in medicine, as are also ferrous phosphate, $\text{Fe}_3(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$, and ferrous carbonate, FeCO_3 . The last-named is contained in chalybeate waters, from which the ferrous carbonate is deposited, on exposure to air as the hydrated oxide.

Ferrule. A short metal tube driven tightly into a hole in an iron or steel pipe and soldered or otherwise secured to another pipe so as to connect the two. It is also a short tapered tube driven into the end of a boiler-tube where it passes through the fire-box plate. The wedging action of the ferrule expands the boiler-tube end and ensures a tight connexion between the boiler-tube and the plate. There are also other types of boiler-tube ferrules. In common speech the word is used of a metal ring on the handle of a tool, and of the thimble-shaped covering at the end of a walking-stick or umbrella to protect it against wear.

Ferry. A public passage-way across water, usually linking up roadways or tracks on both banks. The most usual means of transport is a floating vessel of some kind which, for small loads and short distances, is frequently a flat-bottomed boat, guided by a taut wire cable and propelled by an endless rope. For heavy loads the ferry-boat may be moved to and fro by a windlass on board, which picks up and pays out a chain crossing the bed of the river. Where there is a strong current in one direction only, the ferry-boat may be attached to a chain the other end of which is moored in midstream some distance higher up, the current being used to move the boat across by oblique pressure. See Congo illus.; Train Ferry.

In the Second Great War, the term was also applied to the delivery of aircraft to the depots and first-line units. Ferry Command (*q.v.*) of the R.A.F. was formed for trans-Atlantic operations, and, within Great Britain, Air Trans-



Ferry. The chain ferry which crosses the Tamar from Cornwall to S. Budeaux, nr. Plymouth, Devon

port Auxiliary (*q.v.*) carried out a similar function.

Ferry, JULES FRANÇOIS CAMILLE (1832-93). A French statesman. Born at St. Dié in the Vosges, April



Jules Ferry,
French statesman

15, 1832, he became a lawyer and a journalist. In 1869 he was chosen as deputy for Paris, being already known as a vigorous opponent of the emperor. When Paris was besieged, as prefect of the Seine he was responsible for its government. After being minister at Athens, he returned to the chamber of deputies in 1873 and entered the ministry in 1879. In 1880 he became premier for a short term, and was again premier, 1883-85, being in the meantime minister for education. In 1885 he retired, but was active in politics until his murder by a lunatic, March 17, 1893, just after he had been chosen president of the senate. Ferry did much to promote secular education, and to establish French influence in Africa and Indo-China.

Ferrybridge. Town of the West Riding of Yorkshire, England. It stands on the Aire, 2 m. N.E. of Pontefract, and has a railway station. In 1461 it was the scene of an engagement during the Wars of the Roses. Here is a large electric power station, close to the Great North Road.

Ferry Command. Organization founded by 85 (transport) group of the R.A.F. for ferrying American-built aircraft to Great Britain during the Second Great War. Early in the war the ferrying of military aircraft across the Atlantic was the responsibility of the ministry of Aircraft Production, but in July, 1941, the work was transferred to the newly-formed Ferry Command. A large proportion of the pilots of Ferry Command were recruited from Imperial Airways, and the whole organization was under the command of Air Chief Marshal Sir Frederick Bowhill. In May, 1943, Ferry Command was absorbed by the R.A.F. Transport Command. See Atlantic Ferry.

Fersen, FREDRIK AXEL, COUNT VON (1719-94). Swedish soldier and politician. Of Scottish descent, Fersen was born at Stockholm, and as a young man served with the French army with distinction. In 1748, he fought against Prussia in the Seven Years' War. Marshal of

the Swedish diet in 1755, and again in 1769, Fersen was prominent as leader of the aristocratic party (the "Hats"). From 1786 he was an open and powerful opponent of Gustavus III, and was put under arrest for a time in 1789, after which he retired.

Fersen, HANS AXEL, COUNT VON (1755-1810). Swedish soldier. Born at Stockholm, Sept. 4, 1755, he served in the Swedish army. Afterwards he resided at the court of Louis XVI of France, with whom he became a great favourite. During the American War of Independence he fought under Lafayette. When the king and Marie Antoinette fled to Varennes in 1791, Fersen drove the coach. After his return to Sweden he was murdered by a mob, June 20, 1810, on an unfounded suspicion of having been concerned in the death of the Crown Prince.



Hans von Fersen,
Swedish soldier

Fertile Crescent. Term sometimes used historically for the anciently fertile lands lying W., N., and E. of the Arabian desert between Egypt and the Persian Gulf. They included Israel, Syria, and the Tigris-Euphrates valley.

Fertilisation. Biological term for the union of two dissimilar cells which precedes the production of a new individual by sexual means. Many plants and animals produce two kinds of monoploid reproductive cells or gametes, a smaller and often motile male, and a larger usually non-motile female. Neither can normally continue existence independently.

In some species both male and female reproductive organs are present in the same individual. When dissimilar gametes formed by one organism unite, the process is termed self-fertilisation. In higher animals cross-fertilisation is the rule, and in this process the sperm and the ovum which unite come from two distinct members of opposite sex. Fertilisation is facilitated by the movement of the male gamete. Typical sperms of animals consist of a mainly nuclear head and a propelling tail, which correspond with the body and cilia of the antherozoids of those plants whose male gametes swim to the female to effect zoidiogamous (*Gr. zoidios*, of animals) fertilisation. The male gametes of

other plants have no obvious means of propulsion, but some reach the oosphere by means of fertilisation tubes; the process is then siphonogamous fertilisation.

The female gamete is undoubtedly co-active in bringing about fertilisation: in many, probably all, instances it exudes soluble material to guide the male cell in chemotaxis (*q.v.*); the oospheres (*q.v.*) of a number of lower plants provide a special receptive region through which the male cell enters, and a number of animal ova appear to engulf the male cell when the latter has made contact and active movement has ceased. Female gametes generally also inhibit the entry of more than one male cell by forming membranes around themselves after the first has penetrated. The nuclear portion of the male gamete sometimes, though not indisputably always, accompanied by cytoplasmic structures sinks into the female cell where ultimately all trace of any male cytoplasm is lost and the male nucleus coalesces with the female nucleus. Fertilisation is then complete, and the single diploid cell so formed is a zygote, the first cell of a new organism.

The process of fertilisation has a twofold effect: it initiates the physiological activity which results in development of the zygote; it is complementary to meiosis in the reorganization of nuclear material with the accompanying reassortment of Mendelian characters. Uncertainty of the fate of parts of male gametes other than the nucleus leaves doubt as to whether male parents transmit any characters other than those borne by the nucleus. Since, however, the female gamete habitually has a considerable bulk of material outside its nucleus and this becomes part of the zygote, there is a considerable possibility that female parents may pass on to their offspring characters additional to those carried by the chromosomes. See Cytology; Embryology.

Fertiliser. Substance applied to the soil to furnish plant foods. The term manure is used for organic substances which confer benefits on the soil in addition to providing a plant food. In general, fertilisers contribute one of the essential plant foods, nitrogen, phosphates, or potash, but a few give two or three together. They are described according to the essential plant food they supply, and in relation to the rate at which the particular substance is made available to the plant. Thus,

there are nitrogenous, phosphatic, and potassic fertilisers of quick and of slow acting propensities.

Nitrogen influences the development of stem, leaves, and root and thus the size of the plant; phosphate has an effect on the root; potash is concerned with carbon assimilation and hence with fruit and seed formation. In the absence of potash plants are more liable to fungoid diseases. The optimum effect of any one fertilising constituent cannot be obtained except in the presence of an abundant supply of the other two; hence, unless there is sufficiency of the others, the use of one alone is not recommended.

Of the nitrogenous fertilisers, sulphate of ammonia, nitrate of soda, nitrate of lime, and calcium cyanamide represent the quickly acting form, all possessing a high percentage of nitrogen; calcium cyanamide also has a high percentage of lime. Bones long formed the basis of supplies of phosphate, but now the supply is augmented by quantities of rock phosphate. Raw bones contain about 10 p.c. of fat; when this is removed the resulting product ground is a valuable fertiliser.

Composition of Superphosphate

Superphosphate is water-soluble and obtained by treating bones and rock phosphate with sulphuric acid. Basic slag, a by-product in the manufacture of steel, is another source of phosphate; the latter is insoluble in water but soluble in dilute acids such as exist in most soils. Basic slag also contains lime.

Potash comes from the ash of plants after incineration, the largest supplies from the Stassfurt deposits in Germany, from Alsace, and from Palestine. Potash from these sources exists as chlorides and sulphates in combination with chlorides and sulphates of magnesium and sodium. The amount ranges from about 48 p.c. in sulphate of potash to 12 p.c. in kainit. In Great Britain potash is applied to potatoes, sugar beet, mangolds, and market garden crops, and, on light land, to clovers, permanent grass, and, as far as possible, cereals.

Farmyard manure is by far the most general and valuable of all organic manures; its chemical composition is variable, but an average figure of fertilising constituents is nitrogen 10-15 lb., phosphoric acid 4-9 lb., potash 9-18 lb. Apart from its actual fertilising influence, farmyard manure has a most salutary effect on the physical condition of a soil

by increasing its workability and moisture-retaining capacity, in addition to contributing essential bacteria.

Ferule (Lat., *ferula*, fennel, cane, *ferire*, to strike). Instrument of punishment. The stalk of the giant fennel, *Ferula communis*, was used as a rod or cane, to which it gave its name. The word is applied also to a sole-shaped strap, comparable to the Scottish tawse, with which boys are beaten on the palms of the hands in some schools.

Fescennine Verses. Improvisations in dialogue form made at rustic gatherings in ancient Italy, the origin probably of the native Roman *satura*, or satire, in which the speakers made capital out of the faults and follies of their neighbours. As a feature of wedding celebrations they were commonly characterised by broad licentiousness. Hence the derivation of the name from the Lat. *fascinum*, a phallic emblem, by some etymologists who deprecate its other derivation from Fescennia on the ground that the custom was widespread throughout Italy, and not peculiar to that small Etruscan town. From the Fescennine verses the epithalamium, or nuptial song, was ultimately developed, a literary form of which Catullus, for one, made exquisite use, and which has been successfully reproduced in the literature of many countries, notably by Herrick in England.

Fesch, JOSEPH (1763-1839). French cardinal. Born at Ajaccio, Jan. 3, 1763, the step-brother of Letizia Bonaparte, he was archdeacon of Ajaccio until the French revolution, when he retired. He had always befriended the Bonaparte family, and in 1802 Napoleon made him archbishop of Lyons, and procured for him a cardinal's hat. Ambassador at Rome in 1804, he persuaded Pius VII to crown Napoleon in Paris, and was made grand almoner and senator of the Empire. His position as intermediary between Napoleon and Pius was extremely difficult during 1806-07, and Fesch's relations with both became strained, especially after the Gallican council of 1811, from the presidency of which the emperor dismissed his uncle. Retiring to Rome on the fall of the Empire in 1814, he died there May 13, 1839.

Fescollising. Method of improving the resistance to corrosion or wear of a steel article by depositing electrolytically another metal on the surface. Nickel and chromium are commonly used; they may be deposited only on

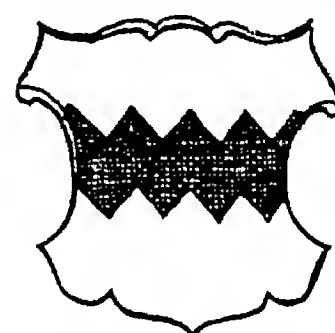
the parts submitted to most wear by protecting the other parts from the electrolyte with a layer of grease, etc. See Electrolysis.

Fescue Grass (*Festuca*)

Extensive genus of grass. Of the family Gramineae, they are natives of cold and temperate regions. The flattened flower spikelets are grouped in panicles or racemes; there being three or more flowers in each spikelet. Many species are

among the most valuable of meadow and pasture grasses, being rich in saccharine matter. Sheep's fescue (*F. ovina*), with bristle-like leaves, which grows in hilly pastures that are dry and open; meadow fescue (*F. pratensis*), and hard fescue (*F. duriuscula*) are most useful for this purpose.

Fess (Lat. *fascia*, band). In heraldry, a horizontal band carried across the middle of the shield



Fess, in heraldry

and occupying one-third of the field. It is one of the ordinaries (*q.v.*). The middle of the field is known as the fess point. A shield or charge divided by a horizontal line in the middle is said to be "per fess"; but if it is divided into any number of horizontal bands above four, it is called "barry." If there are three divisions it is "tierced" or "tiercy per fess"; if four, "quartered per fess." Charges placed in horizontal rows are termed "in fess."

Festiniog OR FFESTINIOG. Urban district of Merionethshire, Wales. It comprises the town of Blaenau Festiniog and the villages of Festiniog (or Llan Festiniog) and Tanygrisiau. Total pop. (1951) 6,923. The town (pop. 5,192) is the industrial centre of the slate



Meadow Fescue, *Festuca pratensis*

quarrying industry of the county. Hydro-electric power schemes embracing Festiniog were being debated in 1952.

Festival (Lat. *festivus*, joyful). Days on which some deity or person was honoured or the memory of some important event kept with certain solemnities, ordinary work being as a rule suspended. Such festivals or feasts no doubt were originally festivals connected with nature's changing phenomena, its decay in winter and renaissance in spring (see Adonis). They were partly merrymakings and thanksgivings for benefits received, partly prayers for benefits to come, and partly ceremonies to appease the anger of the gods for sins committed; even from the last the festive element was not absent.

The Greek festivals were held in honour of national heroes; of gods connected with the fruits of the field, such as the Dionysia, Lenaea, and Eleusinia; and of the tutelary deities of Athens, such as the Panathenaea. The four great games—Isthmian, Nemean, Olympian, and Pythian—set the seal on the national unity. At Rome each family kept the festival of its domestic gods, the Lares and Penates; the public festivals were under the control of the state—festivals in honour of the tutelary deities of Rome, Romulus, Mars, and Quirinus, and of the divinities who presided over the crops, the fields, and boundaries, such as the Cerealia, Lupercalia, Saturnalia, and Terminalia. The public games (*ludi*) were also national festivals. (See *Feriae*; *Ludi*.)

Among the Jews such days are regarded as days appointed by God for meetings with His children. They include Passover, or Unleavened Bread, Nisan 15–22; Pentecost, Sivan 6; Trumpets, or New Year, Tishri 1; the Day of Atonement, or Great Sabbath, observed on Tishri 10, by complete rest and fasting, the only fast not postponed by the occurrence of the Sabbath; the Tabernacles, or Ingathering of the Harvest, Tishri 15–22; Jubilee, at the end of every seven Sabbatical Years; Purim, etc.

Christian festivals are days set apart for rest, thanksgiving, and special observance. Some are fixed, as Christmas; others movable, as Easter. In the Christian calendar the greater festivals are called red letter days; while the lesser are called black letter days.

In the Christian Church the earliest festivals were the love feasts or Agapae (*q.v.*). Confusion has been caused by disregard of

the fact that both authorship and date of festival homilies are uncertain. Until the beginning of the 4th century, record exists only of Easter and Pentecost, though each Friday was a fast in remembrance of the Crucifixion, each Sunday a festival in remembrance of the Resurrection. The feast of the Nativity was first observed c. 300; Christmas, Epiphany and Ascension Day came later.

Days in memory of the Apostles were next observed, and were followed by observance of days devoted to the memory of saints, of the Purification of the Virgin Mary, the Annunciation, the nativity of S. John the Baptist, the Circumcision, the death of martyrs, the transfer of their relics or the consecration of churches dedicated to them. Many Christian festivals are of local origin, some adapted from Jewish and pagan practice, and they increased in number during the Middle Ages. In the Roman Catholic communion, feasts are divided into doubles, semi-doubles, simples, etc., according to the offices appointed for them.

Inclusive of Sundays, festivals in the Anglican calendar number 149; of these the principal have proper collects, epistles, Gospels, and lessons, and some have a proper preface at Holy Communion and proper Psalms. The movable festivals which depend upon Easter are Septuagesima, Rogation Sunday, Ascension Day, Whit Sunday, and Trinity Sunday. In England, public observance of Church festivals, apart from Easter, Whitsun, and Christmas, has fallen into abeyance; all were once made the occasion of some difference in the life of the people.

The chief festivals among Mahomedans, whose rest day is Friday, the day on which Mahomet was born, are the Feast of Bairam, that of Sacrifices, and that following the fast of Ramadan. The Hindus have their festivals, as that of Siva; and among certain N. American Indian tribes is observed a festival called the Day of the Dead. The French Revolutionary calendar included five festival days, dedicated respectively to Virtue, Genius, Labour, Opinion, and Rewards, all in September. See *Calendar*; *Prayer Book*; articles under the name of each festival or saint; consult also *Church Festivals*, A. J. Maclean, in the *Prayer Book Dictionary*, 1912.

Festival of Britain Celebration held in the U.K. in 1951 of

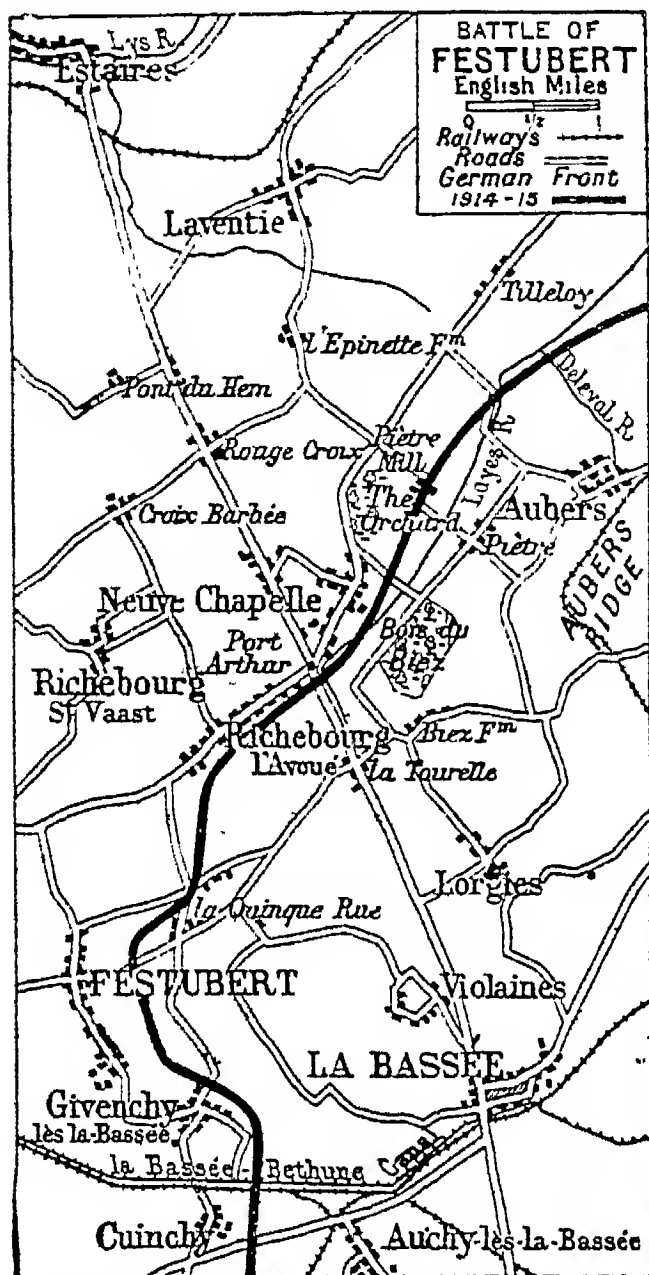
the centenary of the great exhibition, 1851. Many cities and towns took part in the festival; but its centre was the exhibition opened by George VI on May 4 on the so-called South Bank, London, a site of 27 acres on the right bank of the Thames below County Hall. There, among skilfully laid out walks gaily lighted at night and adorned with coloured fountains, British achievements and the British way of life were displayed in a series of varied pavilions.

The Royal Festival Hall, an up-to-date concert hall seating 3,000, was the chief permanent structure. The "dome of discovery," devoted to science and exploration, was the largest temporary building; 365 ft. in diam., it was the widest dome that had ever so far been constructed. When the festival ended on Sept. 30, 8,455,863 had visited the South Bank. Pleasure gardens, with a fun fair, laid out in part of Battersea Park, which remained open until Nov. 3, had 8,031,321 visitors; the pleasure gardens were retained, and the fun fair was reopened in subsequent summers. Total cost of the festival was £10,686,924; total receipts £2,563,199.

Festubert. Village of France in Pas-de-Calais, 3 m. W. by N. of La Bassée. Here, in May, 1915, to assist the French operations in Artois and at Arras, where Foch was attacking, the British First Army (Haig) was ordered to take the offensive on a front N.W. of La Bassée, from Laventie to Richebourg l'Avoué, against the German works on the Aubers Ridge. On the N. portion of this front the 4th corps (Rawlinson) attacked; on the S., the Indian corps (Willcocks) and the 1st corps. On May 9 the infantry advanced after a 40-min. bombardment, but the attack failed with heavy British losses. The total of killed, wounded, and missing exceeded 12,000, without any result, except that the Germans were held down in the section of attack. The failure was due to the weakness of the British artillery.

Nevertheless, French decided to resume the attack, extending it S. to Festubert. On May 15 the British once more assaulted, late in the night, after a prolonged artillery preparation. The troops engaged were the Indian corps on the British left, with the 2nd division at Givenchy and the 7th at Festubert. The Canadian division was placed in support. The 2nd division broke into the German trench system, carrying it for about half a mile,

and the 7th division, attacking E. of Festubert, took another section of the German line, but between these two indentations the Germans could not be dislodged. They counter-attacked in the night of May 16, and forced back the 2nd division slightly, though most of the ground won was held. On



Festubert. Plan of the country over which was fought a great battle of the First Great War

May 17, the British, both from N. and S., assaulted the German wedge, 1,000 yds. long, between the two dents, and cleared it.

The trench battle continued on the following days; the British were much hampered by wet weather and insufficient ammunition, but ground was slowly gained, always at the price of heavy sacrifices. On May 20-21 the Canadians took up the work of the 7th division before Festubert; on May 25 the 47th London Territorial division was put in on the British right at Givenchy, and captured a section of the German line there, which was successfully held. The battle brought little result, as the capture of some thousands of yards of trenches was no compensation for the heavy sacrifices incurred. In killed, the British loss was 3,620; wounded, 17,484; missing, 4,321.

H. W. Wilson

Festus. Poem by Philip James Bailey (*q.v.*). First published in 1839, it was added to and otherwise altered during 50 years until in its

final form, 1889, it consists of about 10,000 lines. A variant of the Faust legend, illustrating the ultimate triumph of good over evil, its scenes take place in Heaven and on the earth, and though it introduces "the three Persons of the Trinity as interlocutors in its wild plot" in a way which many readers resented, it has frequent terse and happy lines which have become familiar quotations.

Festus, PORCIUS (d. A.D. 62). Procurator of Judaea in succession to Felix, about A.D. 58. He heard, in the presence of Herod Agrippa II and Berenice, the case of S. Paul, whom he sent to Rome for trial (Acts 24-25; Josephus's *Ant. of the Jews*, xx, 8; *Wars*, ii, 14). He is said temporarily to have suppressed the Sicarii or Assassins, and was, if cynical, inclined to justice. He is introduced in a powerful short story, *The Procurator of Judaea*, by Anatole France

Festus, SEXTUS POMPEIUS (3rd century A.D.). Latin grammarian. He was the author of an abstract of the important work by Marcus Verrius Flaccus, *On the Meaning of Words*, containing an alphabetical list of obsolete words, together with valuable information concerning old state institutions and ceremonial. Part of it (M-T) has been preserved in the abstract of Festus and a further epitome by Paulus Diaconus (8th century), which is complete.

Feth Ali Shah OR BABA KHAN (1762-1834). Shah of Persia. Nephew of Aga Mohammed, he came to the throne in 1798, and threw himself into a contest with Russia to recover Persia's lost Caucasian territories. This brought him into conflict with Britain in 1812, and by the treaty of Gulistan, 1813, Feth Ali was forced to cede Georgia and seven adjacent provinces to Russia. War with Turkey



Fetishism. 1. Bondu witches or devils from Sierra Leone. 2. Man of Angola worshipping two fetishes. 3. Natives of the Sierra Leone hinterland with their fetishes. See next page.

followed, 1821-23, but neither side gained material advantage. He died at Ispahan, Oct. 20, 1834.

Fetishism (Lat. *factitius*, artificial). Belief that the services of a spirit may be appropriated by the possession of its material embodiment. The 15th century Portuguese navigators applied to the sacred objects of the West African negroes the term *feitico*, which they used of their own amulets. There is, however, a radical distinction between a fetish, which is a subservient spirit in its shrine, and an amulet, which—as in a modern mascot—is merely an instrument of spirit service. So also a fetish is not a god or even a divine image, and fetishism is not idolatry. The term as defined above conveniently describes a phase of the magico-religious life of negro Africa, and an analogous though not identical one of that of aboriginal America.

The fetish spirit may be bodiless or a disembodied soul; it may reside in a shell or a tooth, a hoof or a horn, a bead or a rag. The choice of an object as a fetish is often determined by its unusualness; the Mendi people consecrate to the same use rough soapstone statuettes (British Museum) found in caves abandoned by an earlier race. In the heart of Africa there is a tendency to turn a shapeless stone or a post—by a dab of paint or by crude chiselling—into human semblance. But the fetish is treated as a genie or guardian spirit, rather than as a superior. It is consulted or implored, praised or reproached, treasured or discarded. Its special "medicine" is discovered by experiment; the strings of *wongs* hung about the neck, over the hut door, at the village entry, have their several potencies, giving health, success, children or rain. (See illus. p. 3313.)

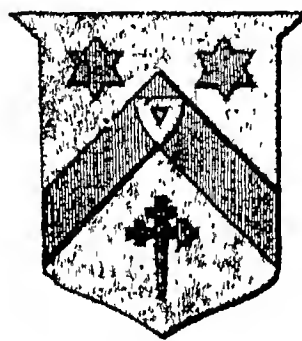
Among the American Indians, spirit-possessed objects are employed in an analogous way. With the Zuni, objects bearing or made to bear an animal semblance are highly prized, especially when consecrated by long tribal tradition. Here, however, a totemic aspect is observable; some objects once classed as fetishes are now perceived to be totems. The Amerind fetish usually differs from the African in possessing an impersonal power which the Iroquois call *orenda* and the Algonquins *manito*. (See Totemism.)

In psychology, the word fetishism is used to describe an abnormal condition in which the sufferer is obsessed by the attach-

ment of sexual significance to everyday objects having no direct sexual association.

Fetter Lane. London thoroughfare linking Fleet Street with Holborn. First mentioned in 1612 and once a way leading to gardens, its name is variously derived from *faitours*, vagabonds; and *feutriers*, felt-makers. The town hostel of the bishops of Norwich was once here. On the W. side is an entrance to Clifford's Inn (*q.v.*), with the Record Office and Breems Buildings, containing Birkbeck College, beyond. In Fleur-de-Lis Court, the scene of Mrs. Brownrigg's murder of her apprentice, Mary Clifford, in 1767, is Newton Hall. Buildings in the middle part of Fetter Lane were destroyed in air raids in the Second Great War.

Fettes College. Scottish public school. Founded with money left by Sir William Fettes (1750-1836),



Fettes College
arms

lord provost of Edinburgh, it was opened in 1870, on a site near Inverleith Park, Edinburgh. It is now governed under a scheme dating from 1886. It possesses a fine range of buildings and laboratories, gymnasium, playing fields, etc. Four boarding houses and a school house accommodate 350 boys.

Feu. In Scotland, land held of a feudal superior on terms involving the payment of a perpetual rent called a feu duty. Land is usually feued for building purposes, the vassal (buyer) undertaking to build. A feu thus resembles a building lease in England.

Feuchtwanger, LION (b. 1884). German writer, born in Munich, July 7, 1884. His first novel was *Jew Suss*, published in 1925 and trans. into English by Willa and Edwin Muir in 1926. It achieved remarkable success, and was made into a play and a film. The *Ugly Duchess* appeared in 1926, trans. 1927. Being a Jew, Feuchtwanger was compelled to leave Germany after the Nazis' advent to power in 1933, and lived in France, but in 1940 was placed in a concentration camp. He escaped to the U.S.A. His later works included *The Day Will Come*, 1942; *Racquel*, the Jewess of Toledo, 1955.

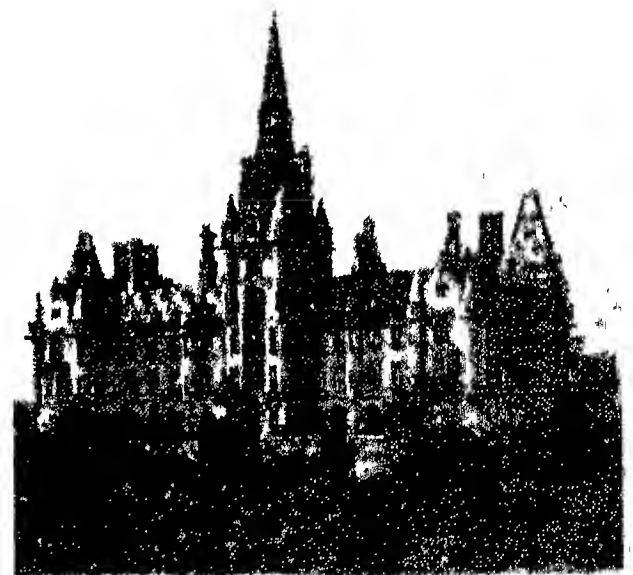
Feud. Word meaning a state of animosity, generally between two parties. It carries the idea of continuous hostility. A notable instance is the feud between the Guelphs and Ghibellines, and there

are instances among the Scottish clans, e.g. between the Campbells and the Macdonalds. See *Vendetta*.

Feudalism (late Lat. *feudum*, A.S. *feoh*, cattle, property). Name given to the social and political structure or organization which grew up on the ruins of the Imperial Roman system in Western Europe during the early Middle Ages. Universally established in its main features by the end of the 11th century, on its political side it was by the 16th century yielding to the effective concentration of the sovereign authority in the hands of supreme central governments.

It was based upon tenure of land. According to the lawyers, every foot of soil was actually the property of the king. Estates had been granted by him to his servants upon recognized conditions. On those conditions the king's "men," "barons," "tenants-in-chief," "vassals," held their lands from their overlord the king. They in their turn had granted portions of their estates upon like conditions to their own men or vassals. The actual occupants of the soil also held their plots of land upon conditions, from their overlord. Except the king, every holder of land was someone's vassal.

The primary condition of holding land was the rendering of military service to the immediate overlord; at the bottom of the



Fettes College, Edinburgh, from the south
J. C. Inglis

scale agricultural or other kinds of service took the place of military service. The vassal rendered homage to his overlord, taking the oath of allegiance and service to him as his man, the lord taking corresponding oath to be "true lord and protector" to his man, the whole system being based upon the recognition of mutual obligations. Since the small landholder was not strong enough to protect himself against a powerful neighbour, and could hardly appeal to a distant overlord for protection it was customary for the small men to "commend" themselves to the

powerful—that is, to surrender their land (since it was alienable) to a lord, from whom they received it back as his tenants or vassals. Custom established the right of hereditary succession in various forms, and the claims a lord was entitled to make upon his tenants.

Broadly speaking, on the continent of Europe, it was generally held that the vassal owed allegiance only to his immediate lord, the result being that the king's great vassals, dukes or counts, could, if they chose to resist him, call upon their own vassals to serve against the king; the royal power depended in effect on the loyalty of the great vassals who individually, or by combination, were strong enough to defy him. Thus when a duke of Aquitaine, a vassal of the French crown in respect of Aquitaine, happened also to be king of England in respect of which he was independent of the French crown, he was able singly to defy his overlord; so also when one person was at once duke of Aquitaine, duke of Normandy, and count of Anjou.

In England the feudal system was not accompanied by an equal danger, because until the 15th century no single feudatories held sufficiently extensive domains to be strong enough to defy the crown except by means of widespread combination. Also, in England, the doctrine prevailed from the first that allegiance to the overlord prevailed over allegiance to the immediate lord. The last remaining relics of feudalism were abolished by the Law of Property Act, 1925. See Manor; Villeinage; consult also Constitutional History of England, W. Stubbs, 1897.

Feu de Joie (Fr., joy-fire). Running fire of musketry used generally on occasions of rejoicing. Ranks of soldiers fire one after another, beginning on the right of the front rank and continuing from the left of the second rank, etc.

Feuerbach, Ludwig (1804–72). German philosopher. Born at Landshut, Bavaria, July 28, 1804, he attended Hegel's lectures at Berlin, and became a tutor at Erlangen. He abandoned teaching for a literary career in consequence of the excitement caused by his *Thoughts on Death and Immortality* (published anonymously 1830), in which he denied the im-



Ludwig Feuerbach, German philosopher

mortality of man. Subsequently inclining towards atheism, he declared the reconciliation of faith and science to be impossible, and in the place of theology substituted anthropology. The body is the very essence of man; the idea of a superhuman power is a fiction of man's own imagination. Man is only what he eats. Sensuous enjoyment is the supreme good, but only attainable by man as a member of society. He died near Nuremberg, Sept. 13, 1872. His other works include *The Essence of Christianity*, 1841, Eng. trans. M. Evans, 1854; and *The Philosophy of the Future*, 1843.

Feuillants. Religious order that flourished in France from the 16th century. It was an offshoot of the Cistercians, and the name originated in their monastery at Feuillant, near Toulouse. The abbot there, Jean de la Barrière, got into trouble with the authorities, so with a following he migrated to Paris in 1587, and founded the new order, one adopting a stricter form of life. A home was given to them in Paris by Henry III, and in 1589 they were recognized formally by the Pope. A later pope divided the order into two branches, French and Italian. The French kept the original name, and at the Revolution had in France 24 monastic houses, including one in the Rue St. Honoré, Paris.

Feuillants. Name of one of the parties that sprang up during the French Revolution. It was given to the members of a club because they met in the building in Paris formerly occupied by the religious order bearing this name. They originated with some Jacobins who, in 1791, refused to ask for the deposition of Louis XVI, and thereafter they formed the moderate wing of the revolutionary party.

They wished to maintain the constitution and to set up a stable government, and at the outset they called themselves the Society of Friends of the Constitution, but they never secured any great amount of support from the populace, although they were the largest party in the Constituent Assembly. Sieyès, Barère, and Lafayette were perhaps the most prominent members. Their wealth and their conservatism brought them under the suspicion of the extremists, and, after the rising of Aug. 10, 1792, their names were published as enemies of France. This put an end to their activities, although the name was still used to describe men holding moderate opinions.

Feuillet, Octave (1821–90). French novelist and dramatist. Born at St. Lô, in La Manche, Aug.

11, 1821, he became an assistant to Dumas the elder. When he started on independent work he soon



Octave Feuillet

achieved considerable popularity with plays and with the novel, *Le Roman d'un Jeune Homme Pauvre*, 1858; this was followed by the mystical romance *Histoire de Sybille*, 1863. In 1862 he was elected to the Academy, and was later made librarian at Fontainebleau. *Monsieur de Camors*, 1867; and *Le Journal d'une Femme*, 1878, were the more notable of his later works. His stories are characterised by a blend of romanticism and realism. He died in Paris, Dec. 29, 1890.

Feuilleton (Fr., leaflet). French word for the part of a newspaper, usually the lower part of a page, devoted to gossip, literary, artistic or dramatic criticism, and especially serial fiction. The practice, though not the name, has been traced to the section in Defoe's *Review* headed *Mercure Scandale*, but the *feuilleton*, as at present understood, originated in the *Journal des Débats* in the early years of the 19th century.

Fever (Lat. *febris*). Condition of the body, the most characteristic feature of which is a rise of temperature. Accompanying symptoms are increase in the pulse-rate, headache, thirst, and, in the early stages, sensations of chilliness which in severe cases may amount to fits of acute shivering or rigors. The skin is usually dry at first, but later there is profuse sweating, and the skin is hot and flushed. The urine may be diminished in amount and is highly coloured. The tongue is often coated, and in children vomiting is frequent. The normal temperature of the body in health varies between 98° and 99° F. Up to 102° F. the fever may be spoken of as "moderate." Temperatures of 105° or 106° are high, and above 106° the term *hyperpyrexia* may be employed. A temperature of 107° F. is very grave and recovery is improbable.

The cause of fever is most often the circulation of a poison in the blood, this toxin upsetting the temperature centre in the brain, and in most cases the poison is a product of bacterial activity of an acute infectious disease. It is now recognized that the rise of temperature indicates the reaction

of the body against the poison in the blood, and, provided it does not reach a dangerous height, it is to be regarded as a beneficial process. The treatment of fever depends upon the disease with which it is associated. Over-high temperatures may be reduced by cold sponging, or the application of an ice-pack.

Certain clinical terms are used to describe various types of fever. Continued fever is the condition in which the fever remains persistently high; in remittent fever there are daily fluctuations of two degrees or more; and in intermittent fever the increased temperature is only present during part of the day. In malaria, when there is a daily rise of temperature, the condition is termed quotidian; when the rise occurs on alternate days the fever is said to be tertian; and when two days elapse between the paroxysms it is quartan. See Scarlet Fever.

Feverfew (*Matricaria parthenium*). A perennial herb of the family Compositae. A native of Middle and S. Europe, it has small, clustered, daisy-like, yellow-centred, white flower-heads. The leaves are deeply cut into toothed oblong segments. The whole plant has a bitter, tonic smell, and was used as a rustic medicine in slight fevers. The name, formerly spelt



Feverfew. Plant and flower of this medicinal herb

feverfuge, is derived from Lat. *febrifugia* (*febris*, fever; *fugare*, to drive away).

Fever Hospital. Hospital for the reception of patients suffering from infectious diseases, e.g. scarlet fever and diphtheria. Such a hospital should be built on a site with a dry subsoil and good fall for drainage. It should be outside the town which it serves but with good facilities for access, and there should be ample grounds. There should be a detached administrative block, separate

wards for patients suffering from different diseases, and out-buildings such as laundry, stores, mortuary, and disinfecting chamber.

In the wards of hospitals the minimum floor space should not be less than 144 sq. ft., and the minimum cubic space 2,000 cubic ft. per head, the system of ventilation providing that air is changed three or four times an hour. A system of one-storeyed pavilions is the best. These should be connected with each other by corridors open to the air. Isolation hospitals for smallpox require a larger space around them than hospitals for other infectious diseases. See Hospital.

Fez OR TARBUSH. Close-fitting cap of felt with a flat top, usually red with a black tassel. It was worn chiefly by the Turks with or instead of a turban (*q.v.*). The name comes from Fez, in Morocco, where these caps were originally made. See Cap colour plate, facing p. 1705.

Fez OR FAZ. City of Morocco, and the northern capital. It is situated in a valley about 100 m. E. of the port of Rabat (*q.v.*), and is one of the sacred cities of Islam. The city, surrounded by ancient walls, is picturesque, and contains the Mosque of the Cherubim or of Muley Edris, to which is attached a Mahomedan university, once the centre of learning in N.W. Africa, with a library containing some 30,000 MSS. The city, which was founded in A.D. 808, is connected with Rabat by a light railway opened 1915. Pop. 144,424.

Fezzan. Name given to the area of Libya lying to the south of Tripolitania. It was occupied by Italian troops towards the end of 1913. Fezzan extends some 400 m. N. and S., and 300 m. E. and W., and belongs to the desert region. The inhabitants are mostly Mahomedans belonging to the Sunnite sect. The chief oases are Ghat in the extreme S.W. and Murzuk. During the campaign of the Second Great War in N. Africa, it was announced on March 6, 1942, that Free French forces from Equatorial Africa had captured three Italian posts in Fezzan after a march of 900 miles. In Dec. Free French motorised

columns again invaded Fezzan, and advancing N. completed the conquest of the territory by Jan. 12, 1943. The Fezzan was in French occupation until included in the kingdom of Libya in 1951.

Ffrangcon-Davies, GWEN (b. 1896). British actress. Daughter of the singer David Ffrangcon-



G. Ffrangcon-Davies, British actress

Davies, she was born in London, Jan. 25, 1896, and educated at Hampstead. She sang soprano lead at the Glastonbury festival, 1919-20, and then scored her first great success as Etain in *The Immortal Hour*. An actress of unusual emotional range, she created the part of Eve in *Back to Methuselah* (*q.v.*), 1923, and became famous by her portrayal of Elizabeth Moulton-Barrett in *The Barretts of Wimpole Street*, 1930. Other memorable parts included



Fez. A street scene in the old part of the city

those of Anne of Bohemia in *Richard of Bordeaux*, 1932; Mary Stuart in *Queen of Scots*, 1934; Mrs. Manningham in *Gas. Light*, 1939; Lady Macbeth, 1942; Agatha in *The Family Reunion*, 1956.

Fiacre (Fr.). Name of a saint and of a hackney carriage. The saint, also known as S. Fiachrach, a native of Ireland, died at Breuil, near Paris, about 670, and is commemorated on Aug. 30. Outside the Hotel de S. Fiacre, in Paris, in the 17th century, was the first stand for hackney carriages, and hence, it is supposed, is derived the application of the name fiacre to the vehicle. See Cab.

Fianna. In early Irish legend, the militia of Ireland, under the leadership of the warrior Finn, later known as Finn mac Cumhal. Their feats bear resemblance to

those of the Arthurian Knights of the Round Table. Cailte, the swift runner, and Oisín (Macpherson's Ossian), son of Finn, were prominent members of the Fianna. In later legend they appear in the reign of Cormac mac Airt, an Irish king of the 3rd century A.D., by whose son Coirpre they were finally quelled at the battle of Gabra, 283. The Anglicised form, Fenians, gave its name to the Fenian Brotherhood, an Irish political organization founded in the 1840s.

Fianna Fáil (Soldiers of Destiny). Irish political party formed by Eamon De Valera (*q.v.*) in 1926, when he broke away from Sinn Féin and the I.R.A. The party entered the Dáil in the second general election of 1927; in 1932 it achieved its first majority and came to power, and its majority subsequently increased until it held in the 1947 Dáil a total of 76 seats against 27 of Fine Gael. After the 1948 elections it still led with 68 seats, but lost its majority and was voted out of office. Fianna Fáil's period of power was marked first by the abolition of the oath of loyalty to the British crown. Later it abolished the post of governor-general, reconstituted the senate, and introduced the constitution of 1937 which provided for the election of a president.

Fiar. In Scots law, name given to the ultimate owner of an estate, the one in whom the ownership is really vested. The *fiar* is, therefore, the opposite of the life renter.

Fiat (Lat., let it be done). Term used in English law for a short order, usually permitting something to be done, made by a judge or high official. Thus a judge's order is required before a newspaper can be prosecuted for libel.

Fiat (abbrev. of Ital. *Fabbrica Italiana Automobile Torino*). A motor, aircraft, and general engineering works at Turin, Italy. Fiat aircraft and aero-engines equipped a large proportion of the Italian air force in the Second Great War; the fighters that escorted the sole Italian raid over Great Britain on Nov. 11, 1940, were of the Fiat C.R. 42 type. The works were frequently bombed by the R.A.F., one of the earliest raids being on Nov. 8, 1940, by bombers making a non-stop flight from England of 1,600 m. Another heavy raid was on Jan. 12, 1941; and on Sept. 9, Stirlings and Halifaxes delivered a low altitude attack. The first 8,000-lb. block-buster used by the R.A.F. was dropped on the Fiat factory on Nov. 2, 1942.

Fibiger, JOHANNES (1867–1928). Danish pathologist. Born at Silkeborg, Jutland, April 23, 1867, he was educated in Denmark and attended medical schools in Germany and Austria. He turned his attention to cancer research, was president of the international conference for cancer, 1913–1920, and was awarded the Nobel prize for medicine in 1926. He died at Copenhagen, Jan 30, 1928.

Fibre (Lat. *fibra*, filament). Term used for threadlike construction or appearance of many substances. Hair, wool, silk threads of the cocoons of silkworms, parts of leaves, bark of certain trees, grasses, etc., are all fibres. Though under certain conditions some metals exhibit a fibrous construction, it is difficult to separate the fibres, but occasionally metals spun into fine threads are spoken of as metal fibres, as also is spun glass. With the exception of asbestos, the fibres of which are woven into a kind of cloth, the fibres of commerce can be conveniently divided into two classes, animal and vegetable.

Animal fibres are the wool and hair of animals, and the silk of insect cocoons. Though comparatively few animals produce commercial fibre, these few are of great importance. Sheep's wool, mohair from the Angora goat, the hair of the llama and alpaca, and those of the cow, camel, and rabbit—the last for felts—and horsehair are the chief commercial animal fibres, and their uses are dealt with under their respective headings.

Vegetable fibres constitute a large and important class, and are put to a greater variety of uses than animal fibres. Flax, China grass or ramie, hemp, jute, cotton, raffia, sisal hemp, tampico, coconut, esparto grass, and Mexican whisk or broom root are among the chief vegetable fibres.

The grasses or fibres of S. America and Africa are collected and sent over to importers in the British Isles, who sell them to the dressers, who in turn cut the fibre to different lengths for various uses and sell it to brush-makers.

Brush-making is an important industry, and an enormous amount of fibre is used, some brush-makers dressing and cleaning their own raw material. The fibre is cleaned of all dirt, cut, and hackled to make it clean and strong; then cut again, dyed if necessary, steamed and so made straight, and then it is left to dry hard.

Palmyra fibre, commonly known as bassin in the brush trade, is a

strong, medium-sized fibre, and is often dyed to look like Bahia piassaba, which is the best material for street brushes, etc. Mexican fibre, of which there are two kinds—tula, which is short, and jumava, a longer variety—is a white fibre which, when dressed, is used for toilet hair brushes, nail brushes, etc. Coco fibre from the husk of the coconut is used for making mats, and also for domestic brushes and brooms.

The principal use of coir yarn is for thatching, though it is sometimes used for large mats. Piassaba, the most important fibre in the brush trade, is used for all kinds of brushes and brooms, and is found chiefly in Brazil and W. Africa. It is also largely used in S. America for rope-making. Kitool, from Ceylon, is the aristocrat of fibres; it is polished and treated with oil, and is expensive. It is used for making fine brushes and also for the manufacture of ropes of good quality.

Various Fibres for Many Uses

Such brushes as dandy brushes for horses are generally made from Mexican fibre. Animal fibre—horsehair, badger's hair, sable, and camel's hair—is extensively used in brush-making. Cheap fibres which pulp easily are used for paper-making. Among them are esparto grass, the paper mulberry (the bark of which is converted into paper extensively used in Japan), cotton grass, and Deccan hemp. From the leaves of *Carludovica palmata* is obtained the fibre from which Panama hats are manufactured; from *Cibotium barometz*, a fern growing in the Sandwich Islands, comes a variety of vegetable silk used for stuffing upholstery work, especially in the U.S.A.; and from *Eriodendron anfractuosum* comes kapok, a soft, silky, elastic fibre used in upholstery, for the stuffing of cushions, seats, etc. See Asbestos; Cotton; Flax; Hemp; Jute; Paper; Rope; Silk; Sisal.

Fibrin (Lat. *fibra*, filament). Threads of solid proteid formed in the process of coagulation of blood. The fine threads entangle the corpuscles of the blood and, gradually shrinking, squeeze out the fluid part of the blood or plasma, the solid mass of fibrin and corpuscles forming the clot. See Blood.

Fibroid. A tumour composed mainly of fibrous tissue, more correctly called a fibroma (*q.v.*). A common tumour of the uterus is spoken of as a fibroid, but is really developed from the muscular tissue. See Uterus.

Fibrolite. Fibrous massive variety of sillimanite. It has the same chemical composition as andalusite and kyanite (Al_2SiO_5).

Fibroma. Tumour composed mainly of fibrous tissue. Soft fibromata most frequently develop from the connective tissue of the skin, and may form pedunculated outgrowths. Hard fibromata are found in connexion with the periosteum or tissue covering the surface bones, the ear, and other parts.

Fibrositis. Disease of an inflammatory nature affecting the fibrous tissue or fascia which surrounds muscles and extends between the muscular fibres. Pain is the most prominent symptom. The causes of the disorder are exposure to cold and wet, sudden chilling after heavy labour, and sometimes a blow. Persons of gouty tendency are most likely to be affected. See Lumbago; Pleurodynia; Stiff Neck.

Fibrous Tissue. Tissue composed chiefly of bundles of fine white fibres. It is found in tendons, ligaments, fascia, and the deeper layers of the skin.

Fibula (Lat., buckle). Outer of the two bones which form the skeleton of the lower leg. It is a long, slender bone, firmly attached to the tibia by ligaments at its upper and lower extremities. The lower extremity forms the external malleolus or bony protuberance on the outer side of the ankle, and helps to form the socket in which the foot articulates with the bones of the leg. See Leg.

Fibula (Lat.). Brooch or clasp. The earliest examples come from late Bronze Age sites in central Europe and are of safety-pin type: a long pin coiled into a spring in the middle and bent so that the two ends fasten together, the upper end being flattened to form a catchplate. In time the upper part, the bow, came to be elaborately decorated and a hinge instead of a spring was adopted.

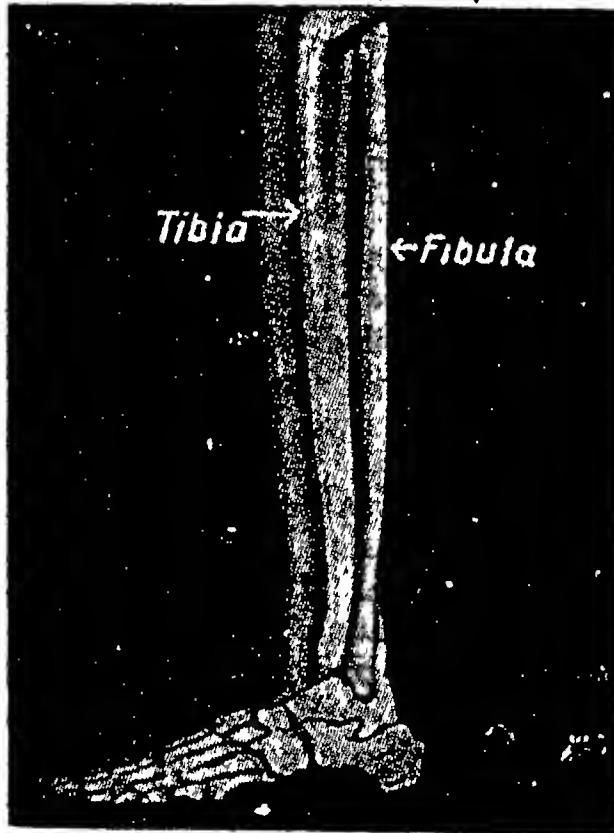
This two-piece fibula was the form used for Greek, Etruscan, and Roman brooches and gave full scope for the exercise of the jeweller's art. Among the Celtic peoples enamel decoration was popular and it continued into the Roman period. The Germanic



Fibula. Merovingian bronze-gilt brooch set with garnets, 7th century

brooches of the migration era are decorated with geometric patterns or stylised animals, and are often inlaid with glass or semi-precious stones. Another form of the Roman period, the penannular brooch, with the pin swinging on a circular bow with a gap at one side, became a favourite late-Celtic type; its most famous example is the so-called "Tara" brooch found near Dublin.

Fichte, JOHANN GOTTLIEB (1762–1814). German philosopher, born at Rammenau, Lusatia, May 19, 1762. The attention attracted by his *A Critique of All Revelation*, written while he was a tutor at Königsberg, helped him



Fibula. Diagram illustrating relative positions of tibia and fibula in the human leg.

to obtain the professorship of philosophy at Jena. In 1799, having been accused of atheism, he resigned his post and retired to Berlin, where he was allowed to lecture on philosophy. In 1807, when the French invaded Prussia, Fichte showed his ardent patriotism in his *Addresses to the German Nation*.



He died at Berlin, Jan. 27, 1814, from a fever contracted during the war of independence.

Fichte's system has been

Johann Gottlieb Fichte
After Büry

called practical idealism, according to which the power of the will in the Ego is supreme. The Ego or self is a purely active being, which derives from itself the entirety of knowledge. It is to the Ego that we have to look for the explanation of everything. The Ego, feeling itself limited,

'posits itself' as determining the non-Ego. The counterpart of whatever belongs to the Ego belongs to the non-Ego. The Ego created the non-Ego; it creates nature and God. But God is not merely a creation of the Ego, but the absolute Ego, the infinite will of the universe, the source of the finite Ego, to which we must ever strive to become united. Fichte's most important work is *The Foundation of the Whole Doctrine of Knowledge*, 1795.

Fichtelgebirge. Mountain system of Germany. Its central nucleus is situated in N.E. Bavaria between the basins of the Regnitz and the Naab. The name is derived from the pine trees (*Fichte*), with which it is largely covered. From it flow the rivers Eger, Saale (to the Elbe), Naab (to the Danube), and Main (to the Rhine). The principal summits are Schneeberg (3,450 ft.) and Ochsenkopf (3,334 ft.). It has connexions with or ramifications into the Erzgebirge and the Thuringian Forest, and contained spas and pottery and china works.

Fiction (Lat. *fictio*, feigning). Term now applied almost wholly to prose romances or novels, although strictly it means anything that is feigned, and is applicable to any literary productions of the imagination. See Literature; Novel; Romance.

Fiction, LEGAL. Legal phrase denoting an assumption of fact without question of its truth, for the purpose of evading technical difficulties. Fictions occur in every system of jurisprudence. They have been invented to enable changes to be effected in the substance of the law while deferring to the wholesome imaginative reverence for its old symbols and formalities. Fictions of law are not allowed to be denied, their proper operation, according to Blackstone, being "to prevent a mischief, or remedy an inconvenience, that might result from the general rule of law," while further the maxim is invariably observed that no fiction shall extend to work an injury.

In England it was through fictions that the courts of king's bench, exchequer, and common pleas encroached on the previously distinct jurisdiction of one another. By the common law no mere civil action could be prosecuted in the king's bench, but plea of any civil action could be held there, other than actions real, if the defendant was an officer of the court, or in the custody of the marshal of the court, for a breach of the peace or any other offence; hence the fiction was introduced into the

pleadings that the defendant had been arrested for a supposed trespass, and so, being in the custody of the marshal, could be proceeded against for any other personal injury.

Similarly in the court of exchequer, personal actions were gradually admitted by the fiction that the plaintiff was the king's debtor, and was prevented from discharging his liability by the failure of the defendant to pay. By another fiction, actions for ejectment were made to serve the purpose of claimants to land, the names John Doe and Richard Roe being employed as those of an imaginary lessee and wrongful ejector.

Other fictions impose a conventional rule where exact facts are difficult to ascertain, *e.g.* the law takes no notice of fractions of a day, so that if a thing is to be done on a certain day, as payment of rent on quarter day, the whole day is allowed for its performance.

Again, in determining the exact moment at which a person becomes 21, the law, in general, disregards fractions of a day. This has a curious result. The law will not inquire as to the particular moment in the day at which the infant was born, and therefore considers that 21 years have elapsed since his birth at the close of the day preceding the 21st anniversary. There is, however, a legal maxim that a day that has begun is regarded as completed; so that at the first moment of the day preceding the infant's birthday, he becomes 21.

Fiddle. Old English name for the violin and its ancestors. It denoted originally any stringed instrument played with a bow, but came in time to be applied chiefly to the smaller sizes of such instruments. Fiddle, with viol, is connected with the Latin *vitulari*, to celebrate a feast.

Fidei Commissum (Lat. *commissum*, entrusted; *fidei*, to good faith). Term of Roman law. By the civil law of Rome, a citizen could neither make a foreigner his heir nor leave him any legacy. As foreign settlers (*peregrini*) became more numerous in Rome, citizens often desired to leave their property, or part of it, to some foreign friend. The only way to do this was to leave the property to a citizen, asking him to carry out the testator's wishes, and hand the property over to the foreigner. At first it was entirely optional on the heir whether he carried out the request or not. It was left to his faith. But, in the end, *fidei commissum* became legally enforceable.

Fidei Defensor. Latin for Defender of the Faith (*q.v.*).

Fidelio. Opera in 2 acts, opus 72 of Beethoven, and his only opera. Based on Bouilly's *Léonore*—an heroic episode during the French Revolution—it was given in 3 acts at Vienna, 1805. It was given in its present form at Vienna in 1814. The work contains fine music, but Beethoven appears to forget the characters and lose himself in contemplation of a moral idea. The famous Leonora overtures were written for this opera: No. 2 for the first production, No. 3 for a shortened revival 1806, No. 1 for a projected performance at Prague, which never materialised. The Fidelio overture preceded the final revision of the opera in 1814.

Fidelity Guarantee. Contract by which a person or persons undertake to make good losses due to fraud or negligence on the part of another person occupying a position of trust.

Fidenae. Town of ancient Latium, about 5 m. N.E. of Rome, on a hill between the Anio and the Tiber. Frequently at war with Rome, it was conquered by Rome 438 B.C., and destroyed 437. It was rebuilt, but never regained its importance.

Fidenza (anc. Fidentia Julia). Town of Italy, in the prov. of Parma. The seat of a bishopric, it lies 14 m. W.N.W. of Parma. It has a handsome Romanesque cathedral, dating from the early 12th century and dedicated to S. Dominus, in whose honour the town was called Borgo San Donnino from 387 until, under the Fascist regime, it reverted to an Italianisation of its ancient name. Fidenza is a market for local agricultural produce. Pop. (1951) 17,537.

Fides. In Roman mythology, the goddess held as symbolical of faith and honour.

F.I.D.O. Initials of Fog Investigation Dispersal Operation. See *under* Fog.

Fiduciary Issue. That portion of the note issue of a central bank which, by law, is not required to be covered by gold. The adjective is used in the sense of "held in trust." Fixing a limit to a fiduciary issue was originally necessary because of the tendency of central banks to overissue their notes, which became valueless. In the Bank Charter Act of 1844 the Bank of England fiduciary issue was fixed at £14,000,000; when in 1928 the treasury note issue was transferred to the Bank of England, the figure was raised to

£260,000,000; by 1939 the permitted issue outside the gold backing was £400,000,000. The need to free all gold held, and subsequently acquired, for overseas purchasing during the Second Great War, coupled with the constantly rising demand for currency, led to repeated additions to the fiduciary issue, so that by 1945 the figure had risen to £1,400,000,000. After the war national expenditure was three times that of the last pre-war years, and the fiduciary issue was maintained at a high figure; in 1950 it was £1,300,000,000.

Power to raise or reduce the limit rests with the treasury in consultation with the governor of the Bank of England, so that adjustments can be made as economic conditions determine. Notes within the fiduciary issue are secured by government securities; it is thus upon these rather than upon gold that currency now rests.

Fief. Name given to an estate held under the feudal system. It was, therefore, one which was held on condition of rendering certain services to an overlord, and which in certain eventualities reverted to that lord. The word is sometimes rendered in English as feu or fee. From it come feoffee, the one who receives the estate, and feoffment (*q.v.*), the act of granting it to him. See Feudalism.

Field. Anglo-Saxon word, meaning the open country. It is now used for a piece of enclosed land *e.g.* a wheatfield, and by analogy we speak of a coalfield or oilfield. It is employed also in a military and sporting sense. In the former, field is a synonym for battle or battleground, *e.g.* the field of Waterloo. This use has many compounds, such as field ambulance, relating to war. In sport the field has various meanings, *e.g.* the horses in a race or the riders at a hunt meeting are the field; in betting parlance, the field signifies all those horses not quoted individually at odds, and in a sweepstakes all horses not drawn separately. Field sports are hunting, racing, and the like. Field events in athletics include putting the weight, throwing the discus, etc. See Cricket; Horse-Racing.

Field. In heraldry, the surface of an armorial shield on which charges are placed. The same term is applied to the body of a flag, *e.g.* the British white ensign is a red cross on a white field, with the union jack in a canton (*q.v.*).

Field, THE. London weekly journal devoted to all forms of sport, natural history, and

country life occupations. Founded Jan. 1, 1853, by Bradbury and Evans, it was first edited by Mark Lemon. Its prosperity dates from its acquisition in 1854 by Mr. Serjeant Cox, and the appointment in 1857 of J. H. Walsh ("Stonehenge") as editor. In 1928 it was acquired by Sir Leicester Harmsworth. *Consult* The Field 1853-1953, R. N. Rose, 1953.

Field, CYRUS WEST (1819-92). American financier. Born at Stockbridge, Mass., Nov. 30, 1819, he made a fortune and retired from business at 33, when he became interested in the idea of the trans-Atlantic cable. In 1854 he organized the New York, Newfoundland, and London Telegraph co., and 10 years later persuaded the U.S. and British governments to confirm by soundings the existence of Telegraph Plateau in the Atlantic. The first cable was laid in 1859. Heavy financial losses necessitated Field's return to business, and he was an originator of the New York elevated rly. He died at New York, July 12, 1892.

Field, EUGENE (1850-95). An American poet and journalist, born at St. Louis, Mo., Sept. 2, 1850. During 1883-95 he contributed to the Chicago Daily News a column entitled Sharps and Flats. His poems include A Little Book of Western Verse, 1889, and With Trumpet and Drum, 1892, charming verses for children. His most attractive essays are collected in The Love Affairs of a Bibliomaniac, 1896. He died Nov. 4, 1895.

Field, JOHN (1782-1837). Irish composer. Son of a violinist, he was born in Dublin, July 26, 1782, and became an assistant in the London pianoforte shop of Clementi & Co. He made his debut as a pianist in London in 1794. In 1802 he accompanied Clementi to France and Germany and then settled at St. Petersburg as a teacher. He died at Moscow, Jan. 11, 1837. Field's nocturnes are reputed to have influenced Chopin in the writing of what was then a new form of composition. His seven concertos had a vogue, but are forgotten. Harty arranged a John Field suite in 1940.

Field, MICHAEL. Pseudonym adopted by two poets who worked in collaboration: Katherine Harris Bradley (born Oct. 27, 1846; died Sept. 26, 1914) and her niece Edith Emma Cooper (born Jan. 12, 1862; died Dec. 13, 1913). Their first joint work, Bellerophon, published under the names of Arran and Isla Leigh, appeared in 1881, and they made use of the

name Michael Field in 1884, when they published Callirrhoe. Later works included The World at Auction; The Race of Leaves; Poems of Adoration; Cedar and Hyssop; Mystic Trees. *Consult* biographies by M. Sturgeon, 1922; T. S. Moore, 1934.

Field Allowance. Emolument granted to an army officer on going into camp or taking the field on active service, in compensation for the extra expense of tent furniture, messing, etc. During the Second Great War the field allowance varied from 2s.-7s. 6d. a day for a second lieutenant to 10s.-£4 for a general officer, according to the theatre of operations. The highest field allowances were paid to officers serving in Burma.

Field Ambulance. Mobile unit of the Royal Army Medical Corps organized in companies to work with forward troops. Nowadays a field ambulance is completely mechanised and is staffed by 10 medical officers and 240 drivers, orderlies, and stretcher-bearers. It is equipped to receive casualties from the casualty clearing stations and has a mobile blood bank. The general principle of the field ambulance is to treat slight casualties which can be returned to their units, and to give primary treatment to serious cases pending their movement to a general or base hospital.

Field Dressing. Antiseptic dressing carried by officers and men of the British army and R.A.F. on active service. It consists of a pad of sterilised gauze, to which is fastened a length of bandage so that it can be securely fastened over a wound. The field-dressing is enclosed in a dust-proof wrapping and carried in a special pocket in the trousers or tunic.

Fieldfare (A.S. *feldefare*, field traveller). A bird of the thrush family (*Turdus pilaris*). Visiting

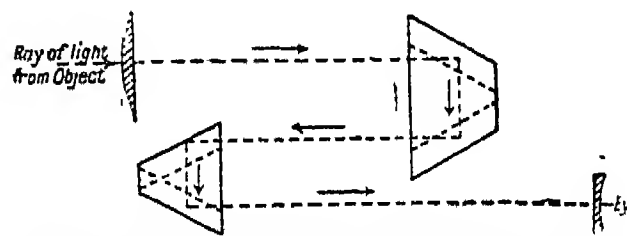


Fieldfare. Member of the thrush family, found in Great Britain

Great Britain in vast flocks in winter, it spends the rest of the year in Scandinavia and Russia. In plumage and general appearance it closely resembles the common thrush, but has not its vocal powers. It is seldom seen in

parties of less than twenty, and often the flock will exceed a hundred. It feeds upon grubs, small snails, and berries. When feeding it continually advances in one direction, and a flock of the birds appears to move forward in open order with almost military precision. Fieldfares nest in great colonies, and return year by year to the same site, the nests being usually built in pine woods.

Field-glasses. Small binocular telescope for viewing distant objects. The earlier field-glasses consisted simply of two short telescopes mounted side by side in a frame and focused by means of a screw. The telescopes were of the "Galilean" type, in which the object-glass is a convex lens which converts the parallel beam of light from a distant object into a convergent pencil of rays. The



Field-glasses. Diagram illustrating path of light in a prismatic field-glass

tube is a short one, and before the converging rays can come to a focus they pass through the concave eye-piece which transmits them to the eye as a parallel beam. In order that the images may be free from coloured fringes, it is necessary to substitute achromatic combinations for the simple lenses.

The advantage of this type of telescope for field-glasses lies in the shortness of the tube; its disadvantage in the narrowness of the field of vision. Rays from objects slightly off the direction in which the glass is pointed get lost inside the tube, and fail to reach the eye-piece. To avoid this defect, prisms were introduced into the tube to catch the aberrant rays and reflect them into the eye-piece. This was the origin of the modern form of field-glass, the prismatic binocular. There may be one object-glass or two, but in either case the entering pencil of rays is reflected twice or more between parallel prisms, and finally directed into the eye-piece. This arrangement gives a wider field than in the simple type of field-glass, but as a certain amount of light is lost at each reflection the field is not so bright. In fact, the prismatic binocular was rendered possible only by the invention of a glass for the prisms which reflected a specially large percentage of the light falling on it. *See* Telescope.

Field Gun. Mobile gun for use with troops in the field. It became a practicable weapon during the Napoleonic wars, replacing the slow-moving and cumbersome cannon that had previously hampered the movement of an advancing army. That used by the British army in the First Great War was horse-drawn and sufficiently mobile to keep in touch with the advancing infantry. It had a calibre of 3.3 ins., fired a shell weighing 18½ lb., and had an extreme range of 9,000 yds. It weighed 1 ton 6 cwt., and the limber 15 cwt. Various types of field gun were developed for the British army in the Second Great War, but the most successful was the 25-pounder gun howitzer, which became the standard weapon for field artillery regiments. It had a calibre of 3.75 ins., an extreme range of 13,000 yds., and could be elevated to 45° and turn in its own length. The replacement of horse transport by mechanical traction raised the limit to the size of field guns, and by 1952 artillery up to 9.2-in. calibre was operating with troops in the field.

Field Hospital. Reception centre and clearing hospital for casualties removed from fighting areas by field or air ambulance. A field hospital, which is highly mobile and can move forward or back at short notice, is manned by the Royal Army Medical Corps, one being attached to every division. When possible, use is made of existing buildings in the battle area, but in the campaigns in North Africa in the Second Great War the field hospital was accommodated in tents and marquees, which were carried by its own transport. In that war a field hospital took 200-300 casualties, and was equipped with mobile operating theatre and X-ray equipment. It retained casualties only until their wounds had been dressed or emergency operations carried out, whereupon they were moved to a base hospital.

Fielding, HENRY (1707-54). English novelist. Born near Glastonbury, April 22, 1707, a scion of the Denbigh family, he was educated at Eton and at the university of Leyden, studying civil law. Coming to London about the age of 20, he began to write for the stage, producing a number of farces and other light pieces that have not lived. Called to the bar in 1740, he was appointed justice of the peace for Westminster in 1748. As presiding magistrate at Bow Street, he founded the first Bow

Street police force. Careless living undermined his originally strong constitution, and he died at Lisbon, whither he had gone for his health, Oct. 8, 1754. His *Journal of the voyage*, a delightful work, was also his last.

Fielding's first novel, *Joseph Andrews*, appeared in 1742. It began as a deliberate caricature of Richardson's *Pamela*, then just published. As the narrative progressed, Fielding became interested in his characters; the caricature fades into the background, and the result is a human and lifelike story. *Joseph Andrews* was followed in 1743 by *Jonathan Wild*, though it seems probable that this grim portrayal of the career of a consummate scoundrel was written first. Then in 1749 came *Tom Jones*, which some critics regard as the greatest novel ever written.



Henry Fielding
From a print

The plot is a masterpiece of construction, the narrative is Homeric in its power to sustain interest, while the hard-drinking, hard-swearing Squire Western, his beautiful and lovable daughter Sophia, the hypocrite Blifil, the egregious humbugs Thwackem and Square, and the ingenuous Partridge are intensely lifelike. "That exquisite picture of human manners," declared Gibbon, "will survive the palace of the Escorial and the Imperial Eagle of the House of Austria."

Fielding's last novel, *Amelia*, 1751, is subdued in tone as compared with the boisterous high spirits of *Tom Jones*. It is to a certain extent autobiographical, the original of the erring Captain Booth being Fielding himself. *Amelia* was the favourite novel of Thackeray, who gives a masterly appreciation of Fielding in his *English Humorists*. There are other *Lives or studies* by A. Dobson, 1907; G. M. Godden, 1910; W. L. Cross, 1919; H. K. Banerji, 1930; B. M. Jones, 1933; M. P. Willcocks, 1946; E. Jenkins, 1948; H. F., *His Life, Works, and Time*, F. Homes Dudden, 1952.

Fielding, SIR JOHN (d. 1780). English magistrate. A much younger half-brother of Henry Fielding (*v.s.*), with whom he was associated for a time as assisting magistrate, he seems to have been

born blind. His blindness did not prevent him from becoming presiding magistrate on his brother's death, in which capacity he extended the police force of that day and vigorously implemented his brother's scheme for breaking up bands of robbers, details of which he published (1755) in a pamphlet entitled *Plan for Preventing Robberies within twenty miles of London*. He was knighted in 1761, and died Sept. 4, 1780.

Field-lens. Part of an optical instrument. The more complex forms of eye-piece used in optical instruments consist of more than one lens in order that chromatic aberration and other image defects may be reduced. In both the Ramsden and Huygens eye-pieces there are two plano-convex lenses, the one next to the eye being termed the eye-lens, and the other the field-lens.

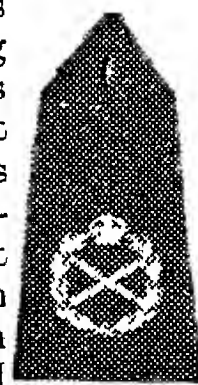
Field Madder (*Sherardia arvensis*). Annual bristly herb of the family Rubiaceae. It is a native



Field Madder. Spray of foliage and flowers, and a detached leaf

of Europe, Asia, and the Canaries. Its trailing stems, a foot or more in length, spread from the root, and are clothed with whorls of sharp-pointed lance-shaped leaves. The lilac funnel-shaped flowers are about ½ in. across. It grows in cornfields and pastures.

Field Marshal. Highest rank in the British army, equivalent to admiral of the fleet in the Royal Navy and to marshal of the Royal Air Force. The first English field marshal was William, earl of Salisbury, who in 1214 was appointed by King John *mariscalcus* of his military forces. At that time the marshal was responsible for maintaining order in court and camp. The modern sense dates from 1736, when George II conferred the rank on John, duke of Argyll.



Field Marshal. Badge on shoulder

Any officer on either the active or the retired list may be promoted field marshal without reference to seniority, but it is laid down that there shall not be more than eight field marshals on the active list. The honorary rank of field marshal in the British Army is sometimes conferred upon foreign kings. Colonels commandant of the Royal Artillery and Royal Engineers, and colonels of the King's Royal Rifle Corps and the Rifle Brigade are selected from the field marshals, who are also eligible for appointment as governors of the Tower of London and of Chelsea Hospital. Rank is indicated by crossed batons surrounded by a wreath and surmounted by a crown. With full dress a baton is carried.

Field Mouse. A name erroneously given to several small rodents, both mice and voles. It is



Field Mouse. Brown long-tailed
Apodemus

correctly applied only to *Apodemus*, the wood mouse, otherwise called the long-tailed field mouse, a common pest in most parts of England, in gardens and hedgerows, and in corn-stacks.

Field Officer. Military officer above the rank of captain and below the rank of general: *i.e.* major, lieutenant-colonel, colonel, and brigadier. Before the age of mechanisation, field officers of infantry regiments were always mounted. Field officers not having any company or squadron responsibilities are generally assigned to special duties, such as presiding at courts martial. A brevet major ranks as a field officer for the period of his brevet, but performs company duties as required. Normally sentries pay compliments to field officers by presenting arms. See Brigadier; Colonel; Major.

Field of the Cloth of Gold. Term applied to the meeting-place of Henry VIII and Francis I of France, June 7-24, 1520. The meeting took place near Guines, and the name was given to it on account of the magnificence displayed on the occasion.

Field Punishment. Punishment authorised by the Army Act to be inflicted on private soldiers

on active service in consequence of the lack of prisons or detention barracks. Field punishment No. 1, abolished in 1923, involved such restraint as is usual in cases of imprisonment with hard labour, and in addition the prisoner could for three days out of four be "attached to a fixed object," such as a tree or a gunwheel, with straps or ropes, for not more than two hours a day. This mode of restraint could not, however, be adopted for more than 21 days in all. See Court Martial.

Fields, GRACIE (b. 1898). Stage name of Grace Stansfield, British variety and screen actress. Born at Rochdale, Jan. 9, 1898, she made her stage debut as a child there, and appeared in London at the Middlesex music hall in 1915. Her broad, Lancashire humour, vitality, and voice rapidly endeared her to audiences, and she became the best known comedienne of the day, appearing in such revues as *Mr. Tower of London*, 1918-25; *Walk This Way*, 1931. She made one appearance on the legitimate stage, in *S.O.S.* at the St. James's Theatre, 1928. In 1931 she made her film debut in *Sally in our Alley*. Her later films included *Stage Door Canteen*, 1943; *Holy Matrimony*, 1943; *Madame Pimpernel*, 1946. She was created C.B.E. in 1938. She married first Archie Pitt, and in 1940 the Italian-born film director Monty Banks (d. 1950) shortly before he became a U.S. citizen, remaining with him for some years in the U.S.A. After his death she returned to Europe, and in 1952 married in Capri Boric Alperovic, a stateless Bessarabian refugee.

Fields, W. C. Stage-name of Claud William Dukenfield (1879-1946). He was born at Philadelphia, Jan. 29, 1879, and first attained fame as a juggler, playing in various parts of the world; after the First Great War he appeared in revues and comedies in New York, *e.g.* *Scandals*, 1922; *Poppy*, 1925. Then he began his film career and developed into a character actor, specialising in studies of alcoholic and humorous eccentrics. His portrayal of Micawber in *David Copperfield* in 1935 was probably his finest achievement. Later films included *My Little Chickadee*, 1940; *The Bank Detective*, 1941. He died at Pasadena, California, Dec. 25, 1946.

Field Spaniel. See Spaniel.

Field Train. Name formerly given to the transport attached to fighting units for the conveyance of the stores, supplies, and baggage necessary for their subsistence.

The term field train has now been replaced by the names first and second line transport: first line transport carries ammunition and rations, second line carries baggage. In infantry regiments each platoon has its own truck for first line transport. See Royal Army Service Corps.

Fieri facias (Lat., cause thou to be made). Term of English law. It refers to a writ of execution directed to the sheriff commanding him to seize and sell sufficient goods of a person against whom a judgement has been obtained to realize the amount of the debt.

Fiery Cross. Charred sticks dipped in goat's blood and usually joined in the form of a cross, which fleet-footed retainers of the chief carried round among the Scottish clansmen to call them together in time of emergency. Disobedience to the summons rendered any man between the age of 16 and 60 liable to the extreme penalties of fire and sword. During the "Forty-five" the fiery cross made many circuits. A fine description of the custom is given in Scott's *Lady of the Lake*, Canto III.

Fiery Serpent. Name given to the serpents sent to the Israelites in the wilderness (Num. 21). They were probably sand snakes, called fiery because of the effect of their bite. See Snake.

Fiescherhorn. Mt. of Switzerland. In the Bernese Oberland (*q.v.*), near Grindelwald, it is 13,285 ft. high. The ascent from the Bergli Hut by the Mönch-Joch needs the help of a guide.

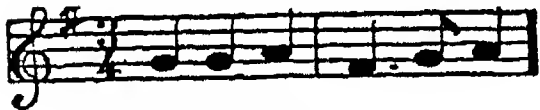
Fieseler. A German aircraft manufacturing company, founded by Gerhard Fieseler in 1930. During the Second Great War it produced the Fi 156, or Storch, designed for communications and army liaison work. This was a small three-seater monoplane with a single 240 h.p. Argus engine. The high wing was fitted with slots and flaps that permitted a landing speed of 24 m.p.h., and, in still air, a landing run of 27 yds., and a take-off in 51 yds.

Fiesole (anc. *Facsulæ*). City of Italy, in the prov. of Florence. It stands on an eminence overlooking the valley of the Arno, 3 m. N.E. of Florence. It was one of the early Etruscan cities, and is enclosed by crumbling cyclopean walls. Its cathedral, founded early in the 11th century, contains many interesting paintings and sculptures. Straw-plaiting is carried on by the inhabitants. Here the Gauls defeated the Romans (225 B.C.), and

Sulla founded a colony of veterans, later the headquarters of Catiline. For long an opulent city, its prosperity waned as Florence grew in power. It was damaged, but not seriously, in the Second Great War; military operations passed over it in Aug., 1944. Pop. (1951) 12,189. *Pron. feeay-zolay.*

Fife (Fr. *fifre*, Ger. *Pfeife*, Lat. *pipare*, to chirp, pipe). Small flute used in association with drums to accompany military marching when a full band is not available. In a drum and fife band the chief melodic work is allotted to the B flat fifes, arranged to play in unison or in two or three parts; they are assisted in lower notes by larger flutes, in F and in E flat, and in the higher ranges by piccolos (*q.v.*) in F and in E flat. As the open key of all the flutes is called D, transpositions are reckoned from D, instead of from C as with most other instruments. For example, the first two bars of God Save the King, in key B flat, would be written as follows to secure a unison effect:

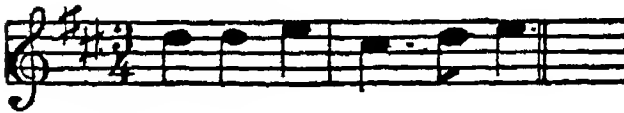
Piccolo in F.



Piccolo in E♭.



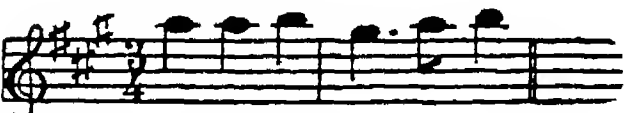
Fife in B♭.



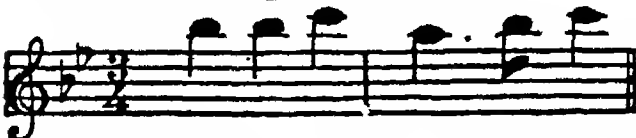
Flute in F.



Flute in E♭.

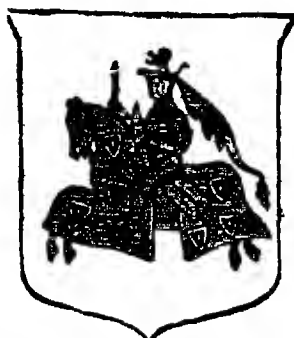


and the actual pitch would be:

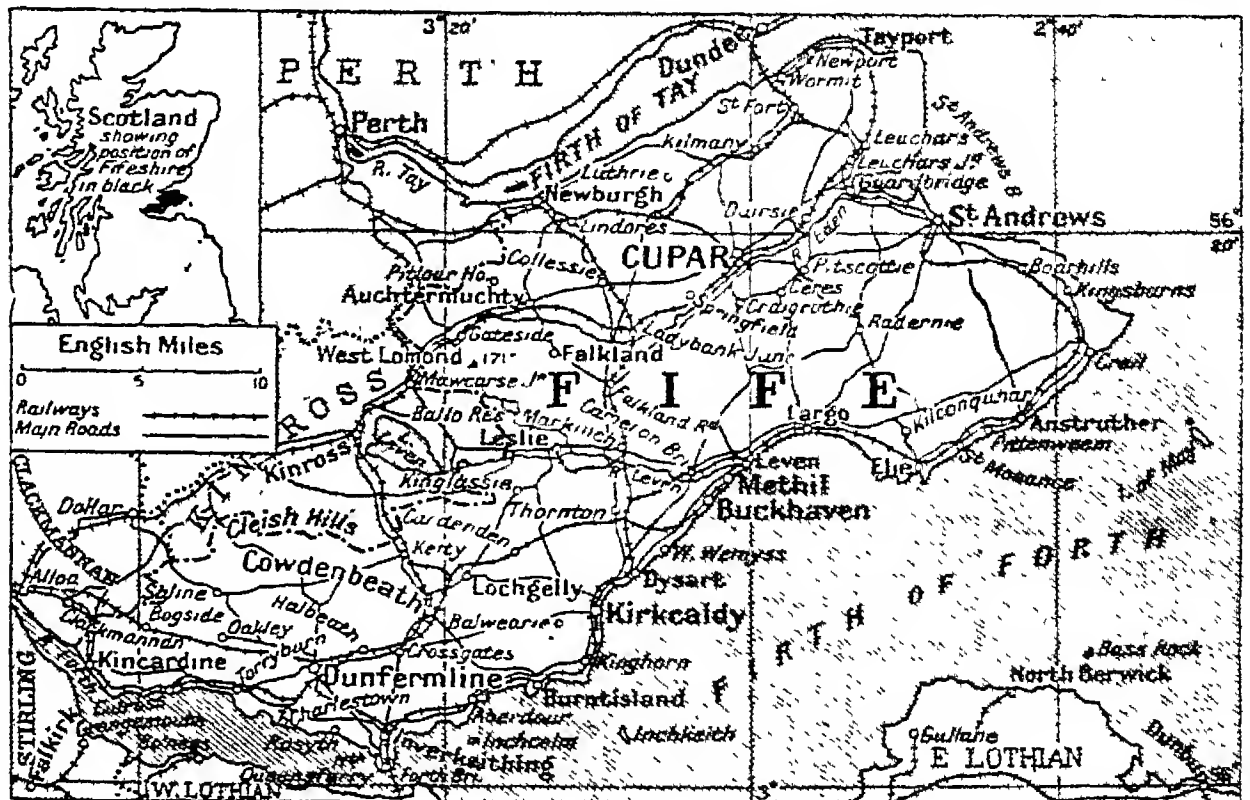


In fife bands the percussion instruments include side-drums, bass drum, cymbals, and triangle.

Fife OR **FIFESHIRE**. Eastern maritime and peninsular county of Scotland. Lying between the Firth of Tay and the Firth of Forth, it covers 504 sq. m. The surface alternates between hill ridges and fertile and well cultivated valleys, the highest eminence be-



Fife arms



Fife. Map of the Scottish county between the Firths of Tay and Forth

ing West Lomond, 1,713 ft. There are several small lakes; the Eden and Leven are the largest rivers.

Nearly 75 p.c. of the soil is cultivated; wheat, barley, oats, and potatoes are raised. The mineral wealth of the county is large, represented mainly by coal around Cowdenbeath, but limestone, ironstone, freestone, and oil-shale are also worked. Most of the coast towns and villages engage in fishing, and the linen and floor-cloth manufactures are prominent.

Under the 1948 redistribution the county of Fife contained two county and two burgh constituencies. Cupar or Cupar Fife is the county town. St. Andrews is the seat of a bishopric and of a Roman Catholic archbishopric; has the oldest Scottish university, founded 1411; and is the headquarters of golf. Evidences of Roman occupation exist, and monastic ruins are found in many parts of the "kingdom," as the county is still popularly called. Pop. (1951) 306,778.

LITERARY ASSOCIATIONS, ETC. To Cupar belonged Sir David Lindsay, the 16th century satiric poet, and another of the Lindsays of Fife was Lady Anne Lindsay, who wrote *Auld Robin Grey*. Adam Smith was born at Kirkcaldy, and Balwearie, near by, was the birthplace of Michael Scott the "wizard." At Lower Largo was born Alexander Selkirk, who is immortalised as Defoe's Robinson Crusoe, and is the subject of a poem by William Cowper. Charles I was born at Dunfermline; his sister Elizabeth, queen of Bohemia, at Falkland; Richard Cameron at the same place; Alexander Henderson at Crieich; Sir Robert Aytoun at Kinlaidie; Thomas Chalmers at

Anstruther; Robert Adam at Kirkcaldy; Sir David Wilkie at Cults. King Alexander III was killed by falling from his horse at Kinghorn. St. Andrews, which is crowded with associations with notable students, has memories of George Buchanan and of John Knox, who began his work as reformer here.

Fife, EARL AND DUKE OF. British titles borne by the family of Duff. In 1735 William Duff, who had been M.P. for Banffshire, was made an Irish peer, as Baron Breco. An earldom followed in 1759. James, the 4th earl, was a major-general in the Spanish army during the Peninsular War, and James, the 5th earl, was made a British peer as Baron Skene in 1857. He died in 1879.

His son and successor, Alexander William George Duff, was born Nov. 10, 1849, and was educated at Eton. He sat in the house of commons for the counties of Elgin and Nairn from 1874 until he succeeded to the peerage in 1879. In 1889 he married Louise, eldest daughter of the prince of Wales (Edward VII), and was created duke of Fife, with (1900) special remainder, in default of male issue, to his first and other daughters (by H.R.H. Princess Louise) and their male issue. He died at Assuan Jan. 29, 1912, from a chill contracted at the wreck of the steamer Delhi off Morocco, and was buried Aug. 8, at Braemar.

His daughter Alexandra, who succeeded as duchess of Fife, was born May 17, 1891, and on Oct. 15, 1913, married her cousin, Prince Arthur of Connaught (1883-1938). Their son Alastair Arthur (1914-43) was known by the second Fife title, earl of Macduff, until in 1942 he succeeded

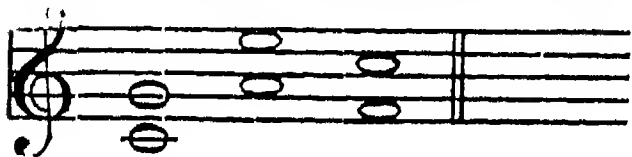
his paternal grandfather as 2nd duke of Connaught. On his death, Maud, younger daughter of the duke of Fife (1893-1945), became heiress to the dukedom of Fife. She married in 1923 Charles Alexander Carnegie (who in 1941 succeeded his father as 11th earl of Southesk), and had a son, b. 1929.

Fifteen, THE. Abbreviation for the Jacobite rebellion of 1715, against the Hanoverian dynasty. On Sept. 6 the earl of Mar raised the standard of King James III, the Old Pretender, at Braemar, but the attempt to restore the Stuart dynasty was defeated by Argyll at Sheriffmuir on Nov. 13. See Jacobites; James Edward.

Fifteenth. In English history, a tax usually associated with a tenth. Taxation of property other than land began in the time of Henry II, and in 1193 one-fourth of their incomes was demanded from laity and clergy alike. Succeeding taxes of this kind were levied, but the amount varied from a fourth to a fourteenth. Officials from the exchequer arranged for a fixed amount from each shire, leaving it to the sheriff to collect it from individuals. After 1290 it was a vote granted by parliament, each estate voting its own share to the king. Tenths and fifteenths became the regular amount of votes, townsfolk, i.e. the owners of personal property, paying one-tenth of their incomes and those in the country one-fifteenth.

The next charge was to make the amount voted a fixed sum, done by taking the assessment of 1332, which produced £39,000. Henceforward £39,000 represented a tenth and fifteenth, and if more money was needed parliament voted two tenths and fifteenths. In later votes certain towns were sometimes excepted, and the assessment became antiquated and unfair as conditions changed. The last vote of this kind was in 1624; its place being taken by the subsidy (q.v.). See Taxation; Tenth.

Fifth. Musical interval. A fifth includes five scale names in order, as C, D, E, F, G. Therefore C to G



is a fifth, and as G occurs in the major scale of C, this fifth is called perfect, or by some major. See Consecutive; Interval.

Fifth Column. Name given to any body of persons who work secretly against the established government, used particularly of

those who, during the Second Great War, sought to aid in the subjugation of their homeland by invaders. This phrase was first used during the Spanish civil war, 1936-39, when the Nationalists attacked the Republicans in four columns, while their supporters within Madrid spread alarmist rumours and committed acts of sabotage and espionage. Fifth columnists in Norway,



Fig. Specimen of the tree *Ficus carica* growing in Palestine. On the right are leaves and fruit of the tree, also enlarged flowers male (right) and female

the Netherlands, and N. France gave effective help to the Germans when they launched their campaign of 1940.

Fifth Monarchy Men. Sect of the Puritan period in England who believed that a millennium or kingdom of Christ upon the earth was at hand. This was to be the fifth monarchy of the world, the earlier ones being the empires of the Assyrians, the Persians, the Greeks, and the Romans. The Fifth Monarchy Men were to be found in considerable numbers in Cromwell's army. In 1661, shortly after the Restoration, they took part in a revolt in which many were killed.

Fig (*Ficus carica*). Tree of the family Moraceae, native of the Mediterranean region. It attains a height of 20 ft. to 30 ft., and has large, lobed, alternate leaves, rough above and downy beneath. The sexes are in separate flowers, but on the same tree. The minute blossoms are contained inside a hollow, pear-shaped flower-stalk. Externally nothing indicates the presence of flowers, and but for the ministrations of a small wasp

(*Blastophaga grossorum*), it would be impossible for the pollen of the males to reach the female flowers. In the same receptacle as the male flowers are some aborted females, and these are attacked by the female wasp, which lays its eggs in them.

The wasp-grubs feed upon their cradles, and in due time become wasps. In seeking the external air they have to pass among the male flowers, and get dusted with their pollen. Then they are attracted by the odours emanating from a cavernous stalk containing female flowers, and enter it, shaking off much of the pollen that covers their bodies; and thus the female flowers are pollinated and the flower-stalks become swollen and juicy. Numerous other species of the genus *Ficus* in other parts of the world bear edible fruit, such as *F. roxburghii* (India), which grows them in clusters from the bare trunk, quite near the ground.

Figaro. Central character, the barber himself, in Beaumarchais' comedy, *The Barber of Seville*. Valet, poet, dramatist, etc., he is the personification of the easy

gaiety which has come to be accepted as a type of the witty social philosopher. Encouraged by the success of *The Barber of Seville*, 1775, Beaumarchais wrote *The Marriage of Figaro*, which, however, was not acted until 1784, and he also

introduced Figaro into *La Mère Coupable*, 1792. Mozart wrote an opera on *The Marriage of Figaro*, and Paisiello and Rossini each wrote one on *The Barber of Seville*. See Beaumarchais.

Figaro, LE. Satirical journal founded in Paris in 1826 and named after Beaumarchais' hero. Contributed to by Jules Janin, Alphonse Carr, and George Sand, it ran till 1833. The title was revived for a weekly started by J. H. de Villemessant, 1854. This became a right-wing morning daily devoted to politics and literature in 1866, its writers including About, Hanotaux, Loti, Rostand, and Barrès. Under the control (1901-14) of Gaston Calmette, who was shot by Mme. Caillaux, wife of the French finance minister, March 16, 1914, it enjoyed a great vogue. It published a literary supplement, and a monthly periodical, *Le Figaro Illustré*.

From the German occupation in 1940, *Le Figaro* voluntarily ceased publication rather than

cooperate with the Nazis. After the liberation of France, 1944, it soon reappeared, edited by Pierre Brisson. It trebled its circulation within a year and established itself as a moderate right-wing paper without specific party allegiance.

Fighter. An aircraft primarily intended for aerial combat. In the First Great War such aircraft were designated scouts because in the opening phase they were employed largely on reconnaissance; aerial combat had not become a reality. In 1915 these scouting machines were fitted with machine-guns, and their purpose changed; they were no longer observation aircraft but fighters, for their pilots were called upon to seek, engage, and destroy enemy aircraft. The type name was retained, however, until some years after the war ended.

The first scouts (or fighters) were capable of top speeds of only about 65 m.p.h., but by the end of 1916 British, French, and German machines were flying at over 100 m.p.h. Engine power rose from 80 h.p. to 200 h.p., and by 1918 some fighter aircraft went into action with four machine-guns installed. With few exceptions all these aircraft were biplanes. The general use of metal in the construction of fighter aircraft in the post-war years was followed by development of the monoplane type.

Increase in Engine Power

At the outbreak of the Second Great War British and German fighters were equipped with engines of more than 1,000 h.p. The essential requirements of all fighter aircraft were and remained abundant engine power, high speed, and formidable armament. Through increasing the h.p. of the engines used in 1939 from 1,030 to more than 2,000 in 1945, the fighter speeds rose from about 340 m.p.h. to more than 460 m.p.h. The machine-gun was gradually replaced by cannon and rocket projectiles. To enable the aircraft to operate at altitudes of 40,000–50,000 feet, special superchargers and special airscrews were introduced. The cockpits were sealed and pressurised to make it possible for the pilot to breathe at such altitudes. Petrol tanks could be dropped from the aircraft when the additional fuel they contained had been expended. The most important change in fighter design introduced during the war was the use of the gas turbine-driven compressor units producing jet propulsion. The R.A.F. and the Luftwaffe employed such

aircraft operationally in the last phase of the conflict, speeds of more than 500 m.p.h. being attained.

Closely related to the true fighter were the fighter-bomber and the night fighter. The former was a variant of the normal fighter. It carried bombs weighing up to 1,000 lb. on external bomb racks, and when so loaded was employed in low level attacks on small targets, either moving or static. For the night fighter, the primary task was engagement with enemy bombers. Its essential qualities were long range, speed, and powerful armament. Whereas the ordinary fighter aircraft was a single-seat machine, the night fighter usually carried a pilot and a navigator. Naval fighting aircraft, flown from aircraft carriers, were extensively developed during the Second Great War. In the post-war years the transonic fighter armed with guided missiles was introduced, and all such aircraft were jet-propelled.

Fighter Command. Operational command of the Royal Air Force responsible for the interception and destruction of enemy aircraft, the escort of bombers, the carrying out of offensive sweeps and patrols, and, in conjunction with Coastal Command, the protection of shipping. Fighter Command evolved from the squadron of reconnaissance, artillery spotting, and photographic survey aircraft which in 1912 formed the nucleus of the Royal Flying Corps. The machines were totally unfit for fighting and little was known about the implications of aerial combat. The only armament consisted of revolvers or rifles carried by pilots and observers.

In the early months of the First Great War, pistols, rifles, small grenades, and incendiary bombs were the sole armament of military aircraft. The scout aircraft performed the elementary functions of a fighter and air fighting tactics consisted in getting above an enemy aircraft and attempting to drop an incendiary bomb on top of it. Early in 1915 the Germans began to make armed reconnaissance flights and bombing raids over the British lines. To combat this new development of air warfare, a number of Bristol and Martinsyde scout aircraft were fitted with machine-guns on the side of the fuselage and set at an angle to clear the airscrew. Somewhat later, machine-guns were fixed to fire through the propeller, being actuated by a synchronising

gear. By 1918, fighter tactics became highly developed, but with one or two exceptions similar types of aircraft were used for both fighting and bombing.

After 1918, the development of aircraft with great range and heavy load capacity led to the evolution of aeroplanes designed for the specific purpose of bombing. To combat the bomber, designers concentrated upon the production of a high speed aircraft with a rapid rate of climb and sufficiently sturdy to carry eight machine-guns. This led to the evolution of the fighter pure and simple, and the establishment, July 14, 1936, of Fighter Command to develop and exploit the tactics of air fighting. The command was divided into groups, which were subdivided into wings, themselves consisting of several squadrons. The squadrons were stationed at aerodromes controlled by their appropriate groups and equipped with day or night fighters or fighter-bombers, according to the particular operational duties of the wing. Fighter Command coordinated not only the operations of the fighter squadrons, but of all other weapons used against hostile aircraft. It issued the orders and warnings which set the air defence system in motion.

Radio-Telephony Control

Aerodromes under Fighter Command were ranged in sectors, a specified number of sectors being controlled by one of the groups, and the groups themselves being under Command H.Q. An elaborate system of communications controlled the whole, and each sector controlled by radio-telephony the movements of all fighter aircraft in the air. Operations rooms at sector, group, and H.Q. plotted all information about hostile aircraft, and at Command H.Q. provided a picture of the entire air battle front. On all operational stations in wartime a squadron of fighters was kept at three-minute readiness to take the air upon receipt of orders from the controller.

Squadrons from Fighter Command accompanied the B.E.F. to France in Sept., 1939, but in the first months of war their activities were mainly confined to armed reconnaissance and the protection of aircraft engaged in aerial photography. With the German invasion of Norway, France, and the Netherlands, Fighter Command was called upon to take up its true rôle; but necessarily retained the bulk of its squadrons in Great Britain to repel anticipated

bombing raids. Its work was restricted to operations designed to delay the advancing enemy and cover the evacuations from Norway and Dunkirk.

Following the defeat of France, Fighter Command disposed its resources for the coming battle of Britain (*q.v.*). No. 11 group, protecting London, the Thames estuary, and S.E. England as far as Portsmouth and East Anglia, bore the brunt of the fighting. No. 10 group protected southern England W. of Portsmouth and also South Wales; No. 12 group the Midlands and east coast from Great Yarmouth to Scarborough. No. 13 group was responsible for the Tyne, Tees, Forth, and Clyde areas and the Scottish east coast. Squadrons from No. 13 had been the first units of Fighter Command to go into action over Britain, when they attacked the German bombers raiding the Firth of Forth on Oct. 16, 1939.

In July, 1940, immediately before the battle of Britain opened, Fighter Command had a front line strength of 640 aircraft, Hurricanes and Spitfires with a few Defiants. Against them the Luftwaffe was able to dispose 1,200 long-range bombers, 1,100 twin- and single-engine fighters, and 350 dive-bombers operating from aerodromes set in a great crescent from Amsterdam to Brest. During the battle of Britain, Fighter Command had the major share in destroying 1,733 German bombers. The command lost 375 pilots killed and 358 wounded in the battle.

Offensive Fighter Sweeps

With the decline of the raids on Great Britain, squadrons of Spitfires and Hurricanes were detailed by Fighter Command to sweep over N. France as escorts to groups of day bombers. The first all-fighter sweep was made Jan. 10, 1941, when 100 Hurricanes flew over the Pas de Calais, attacking enemy aerodromes and road and rail transport. On subsequent occasions 1,000 fighters a day were often engaged in such sweeps.

In Jan. also Fighter Command introduced intruder patrols. These consisted of night sorties over enemy territory for the purpose of shooting down German aircraft over their bases as they took off or returned from raids over Great Britain. Somewhat later the command put into service fighter-

bombers, dropping an average of 135,000 tons of bombs a year. Another development was the night fighter. In conjunction with the Fleet Air Arm, the command also provided pilots and aircraft for the fighters catapulted from merchant ships.

On Nov. 15, 1943, the command was temporarily suspended, defensive fighters being incorporated into a new command known as Air Defence of Great Britain. The fighter squadrons engaged in sweeps and those working in close support of the army were embodied in what was known as tactical air force (*q.v.*). But Fighter Command was reformed on Oct. 15, 1944. Throughout the Second Great War, the command lost 3,558 aircraft and suffered 12,481 casualties, of which 3,143 were pilots killed on operational sorties. See Air Defence of Great Britain; Air Fighting; Fighter; Royal Air Force.

David Le Roi

Fighting Fish. Name given to various species of small fresh-water fish, *e.g.* *Betta pugnax*, found in Asia and Africa. The Siamese breed it for contests, as it fights furiously when matched with an opponent. It assumes vivid hues when excited.



Fighting Fish. Specimen of the Japanese *Betta splendens*

Fighting France (*La France Combattante*). Title adopted on July 14, 1942, by Free France (*q.v.*). The French National Committee (*q.v.*) felt Fighting France to be a more exact definition of the Free French movement, since it linked Frenchmen fighting outside France with those resisting the Germans inside the country. The French National Committee and the British government agreed that Fighting France was the symbol of resistance to the Axis (*q.v.*) by all French nationals, wherever they might be, who repudiated the capitulation of June, 1940, and that the French National Committee was the directing organ of Fighting France. See Gaulle, Charles de.

Fighting Top. In ancient naval warfare, a platform or large barrel high up on the mast from which heavy weights could be thrown into any vessel lying alongside, either to disable men or to drive a hole through the bottom of the ship. Later on, fighting tops were occupied by archers and riflemen; in sailing ships they were represented by the "tops," or platforms built at the head of the

lower masts, where picked marksmen were stationed during close-fought actions. From the mizen-top, the platform on the after-mast, of the Redoubtable the shot was fired that killed Nelson.

In the later years of the pre-Dreadnought era fighting tops were equipped with machine and light quick-firing guns for driving off hostile torpedo-craft, but as the size of the latter and the range of torpedoes increased, it became impossible to mount in these positions guns sufficiently heavy and far-reaching for the purpose. Warships continued to have large structures built high up on the masts, but these were occupied in action by the spotting officers and apparatus connected with fire-control. On some warships the foremast and fighting top were replaced by an armoured control tower, from which the main armament was ranged and fired. This tower was known as the citadel. See Battleship.

Figig. Walled oasis of Morocco, on the borders of Algeria. It lies 3 m. N.E. of Beni Unif, and 165 m. E.S.E. of Fez, and is a station on the rly. from Oran to Colomb Béchar. There are 250,000 date palms and a considerable trade is carried on with Morocco. The inhabitants belong to the Amour tribe. After a revolt in 1903, order was established by a French military mission. Alt. 2,700 ft.

Figl, LEOPOLD (b. 1902). Austrian politician. Born in Upper Austria, he studied agricultural engineering in Vienna and became an active member of the Clerical party led by Seipel, Dollfuss, and Schuschnigg. He was interned by the Nazis soon after their annexation of Austria in 1938, and spent some six years in Dachau concentration camp. Liberated in 1945, he reconstructed the R.C. or People's party, which at the general election of Nov., 1945, secured 51 p.c. of the seats.

Figl was chancellor of Austria during 1945-53, and later in 1953 accepted appointment as foreign minister.

Figline. Town of Italy, in the prov. of Florence. It stands on the river Arno, 15 m. by rly. S.E. of Florence. It manufactures wine and cutlery, and straw-plaiting is carried on. In the vicinity is Monte Ferrato (alt. 1,385 ft.), noted for its quarries of serpentine. Pop. (1951) 13,134.

Fig Marigolds (*Mesembryanthemum*). Large genus of flesh herbs and sub-shrubs. Belonging to the family Picroideae, they are

natives of hot, dry climates, especially S. Africa. The leaves vary greatly in the different species; the flowers are large and conspicuous, white, yellow or red, with many long, slender petals. See Ice-plant.

Figueira, GUILLEN (c. 1190-1250). One of the later Provençal troubadours. He was born at Toulouse, and is reported to have been a tailor. When the persecution of the Albigenses took place he wrote vigorously in their defence, and on the persecutors' capture of Toulouse took refuge in Italy. In the struggle between the Empire and Rome he sided with the former, and one of his *sirventes* is a denunciation of the latter. He also composed some notable love songs. *Pron.* Feegay-eera.

Figueras. Town of Spain, in the prov. of Gerona. It stands in a fertile plain near the French frontier, 27 m. N.E. of Gerona on the Barcelona-Perpignan rly. The town is strongly fortified, with a citadel built by Ferdinand VI, which is considered a key to the frontier. There is important trade in soap, wine, leather, cork, and textiles. The town fell three times to the French—in 1794, 1808, and 1823. At the close of the civil war of 1936-39, following the fall of Barcelona, Jan. 26, 1939, the Spanish Republican government fled to Figueras, but the town was captured by Franco's forces on

Feb. 8, after a heavy toll of civilian life through bombardment. The last meeting of the Cortes was held here on Feb. 3, only 62 deputies being present out of 473. Pop. (1950) 16,589.

Figueras y Moràcas, ESTANISLAO (1819-82). Spanish statesman. Born at Barcelona, Nov. 13, 1819, he studied law. As a republican he was elected to the Cortes in 1851. Prominent in the revolution of 1868, he strongly opposed all attempts to restore the monarchy, and upon the establishment of the republic of 1873 became president of the provincial council of ministers. He occupied a prominent position in politics until 1874, when the restoration drove him into retirement. He died at Madrid, Nov. 11, 1882.

Figurate Number. Term used in mathematics. In an arithmetical progression, if the first number is a unit and the successive numbers differ from it by whole numbers, as in such a series as 1, 2, 3, 4, 5, then a new series may be formed by adding together the first two terms, then the first three terms, then the first four terms, etc. The new series would thus be 1, 3, 6, 10, 15. These numbers are called figurate numbers. Similarly another series, 1, 4, 10, 20, 35, etc., might be formed from the second series.

Figured Bass. In music, a bass part provided with figures to indi-

cate the chords which should be added to it. See Basso Continuo.

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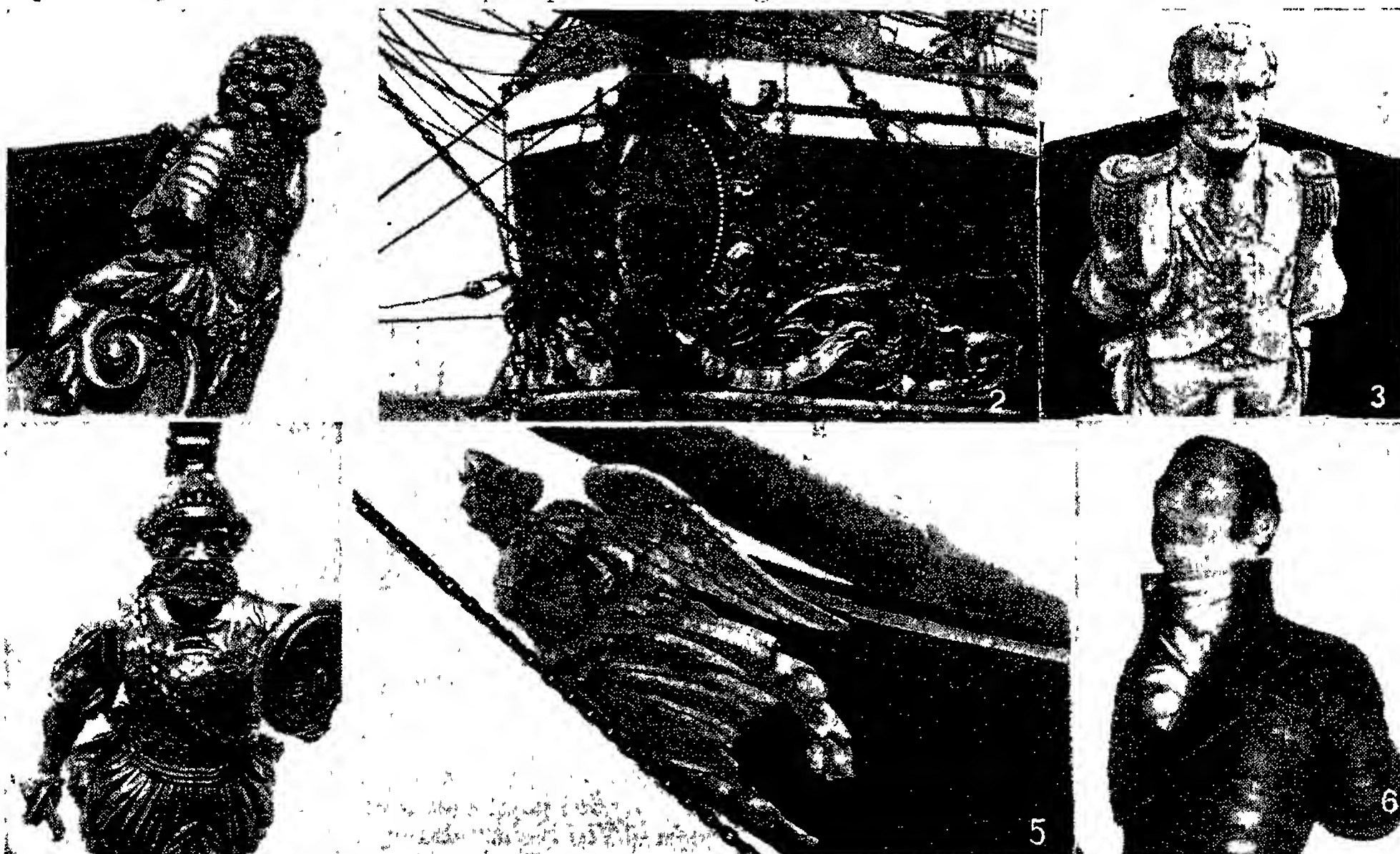


Figure-Heads in the Royal Navy. 1. Marlborough, old three-decker wooden sailing ship now in Portsmouth harbour. 2. Minotaur, ironclad cruiser built in 1863. 3. Duke of Wellington, built in 1852. 4. Warrior, the first ironclad, launched in 1860. 5. Iris, steam and sail ironclad built in 1877. 6. Figure-head intended for Royal Frederick, 1841

Photos 1, 2 and 5, H. Symonds & Co., Portsmouth; 3, 4 and 6, Cribb, Southsea

bombing raids. Its work was restricted to operations designed to delay the advancing enemy and cover the evacuations from Norway and Dunkirk.

Following the defeat of France, Fighter Command disposed its resources for the coming battle of Britain (*q.v.*). No. 11 group, protecting London, the Thames estuary, and S.E. England as far as Portsmouth and East Anglia, bore the brunt of the fighting. No. 10 group protected southern England W. of Portsmouth and also South Wales; No. 12 group the Midlands and east coast from Great Yarmouth to Scarborough. No. 13 group was responsible for the Tyne, Tees, Forth, and Clyde areas and the Scottish east coast. Squadrons from No. 13 had been the first units of Fighter Command to go into action over Britain, when they attacked the German bombers raiding the Firth of Forth on Oct. 16, 1939.

In July, 1940, immediately before the battle of Britain opened, Fighter Command had a front line strength of 640 aircraft, Hurricanes and Spitfires with a few Defiants. Against them the Luftwaffe was able to dispose 1,200 long-range bombers, 1,100 twin- and single-engine fighters, and 350 dive-bombers operating from aerodromes set in a great crescent from Amsterdam to Brest. During the battle of Britain, Fighter Command had the major share in destroying 1,733 German bombers. The command lost 375 pilots killed and 358 wounded in the battle.

Offensive Fighter Sweeps

With the decline of the raids on Great Britain, squadrons of Spitfires and Hurricanes were detailed by Fighter Command to sweep over N. France as escorts to groups of day bombers. The first all-fighter sweep was made Jan. 10, 1941, when 100 Hurricanes flew over the Pas de Calais, attacking enemy aerodromes and road and rail transport. On subsequent occasions 1,000 fighters a day were often engaged in such sweeps.

In Jan. also Fighter Command introduced intruder patrols. These consisted of night sorties over enemy territory for the purpose of shooting down German aircraft over their bases as they took off or returned from raids over Great Britain. Somewhat later the command put into service fighter-

bombers, dropping an average of 135,000 tons of bombs a year. Another development was the night fighter. In conjunction with the Fleet Air Arm, the command also provided pilots and aircraft for the fighters catapulted from merchant ships.

On Nov. 15, 1943, the command was temporarily suspended, defensive fighters being incorporated into a new command known as Air Defence of Great Britain. The fighter squadrons engaged in sweeps and those working in close support of the army were embodied in what was known as tactical air force (*q.v.*). But Fighter Command was reformed on Oct. 15, 1944. Throughout the Second Great War, the command lost 3,558 aircraft and suffered 12,481 casualties, of which 3,143 were pilots killed on operational sorties. See Air Defence of Great Britain; Air Fighting; Fighter; Royal Air Force.

David Le Roi

Fighting Fish. Name given to various species of small fresh-water fish, *e.g.* *Betta pug-nax*, found in Asia and Africa. The Siamese breed it for contests, as it fights furiously when matched with an opponent. It assumes vivid hues when excited.



Fighting Fish. Specimen of the Japanese *Betta splendens*

Fighting France (*La France Combattante*). Title adopted on July 14, 1942, by Free France (*q.v.*). The French National Committee (*q.v.*) felt Fighting France to be a more exact definition of the Free French movement, since it linked Frenchmen fighting outside France with those resisting the Germans inside the country. The French National Committee and the British government agreed that Fighting France was the symbol of resistance to the Axis (*q.v.*) by all French nationals, wherever they might be, who repudiated the capitulation of June, 1940, and that the French National Committee was the directing organ of Fighting France. See Gaulle, Charles de.

Fighting Top. In ancient naval warfare, a platform or large barrel high up on the mast from which heavy weights could be thrown into any vessel lying alongside, either to disable men or to drive a hole through the bottom of the ship. Later on, fighting tops were occupied by archers and riflemen; in sailing ships they were represented by the "tops," or platforms built at the head of the

lower masts, where picked marksmen were stationed during close-fought actions. From the mizentop, the platform on the aftermast, of the Redoubtable the shot was fired that killed Nelson.

In the later years of the pre-Dreadnought era fighting tops were equipped with machine and light quick-firing guns for driving off hostile torpedo-craft, but as the size of the latter and the range of torpedoes increased, it became impossible to mount in these positions guns sufficiently heavy and far-reaching for the purpose. Warships continued to have large structures built high up on the masts, but these were occupied in action by the spotting officers and apparatus connected with fire-control. On some warships the foremast and fighting top were replaced by an armoured control tower, from which the main armament was ranged and fired. This tower was known as the citadel. See Battleship.

Figig. Walled oasis of Morocco, on the borders of Algeria. It lies 3 m. N.E. of Beni Unif, and 165 m. E.S.E. of Fez, and is a station on the rly. from Oran to Colomb Béchar. There are 250,000 date palms and a considerable trade is carried on with Morocco. The inhabitants belong to the Amour tribe. After a revolt in 1903, order was established by a French military mission. Alt. 2,700 ft.

Figl, LEOPOLD (b. 1902). Austrian politician. Born in Upper Austria, he studied agricultural engineering in Vienna and became an active member of the Clerical party led by Seipel, Dollfuss, and Schuschnigg. He was interned by the Nazis soon after their annexation of Austria in 1938, and spent some six years in Dachau concentration camp. Liberated in 1945, he reconstructed the R.C. or People's party, which at the general election of Nov., 1945, secured 51 p.c. of the seats.

Figl was chancellor of Austria during 1945-53, and later in 1953 accepted appointment as foreign minister.

Figline. Town of Italy, in the prov. of Florence. It stands on the river Arno, 15 m. by rly. S.E. of Florence. It manufactures wine and cutlery, and straw-plaiting is carried on. In the vicinity is Monte Ferrato (alt. 1,385 ft.), noted for its quarries of serpentine. Pop. (1951) 13,134.

Fig Marigolds (*Mesemb. yanthemum*). Large genus of fleshy herbs and sub-shrubs. Belonging to the family Ficoideae, they are

natives of hot, dry climates, especially S. Africa. The leaves vary greatly in the different species; the flowers are large and conspicuous, white, yellow or red, with many long, slender petals. See Ice-plant.

Figueira, GUILLEN (c. 1190-1250). One of the later Provençal troubadours. He was born at Toulouse, and is reported to have been a tailor. When the persecution of the Albigenses took place he wrote vigorously in their defence, and on the persecutors' capture of Toulouse took refuge in Italy. In the struggle between the Empire and Rome he sided with the former, and one of his *sirventes* is a denunciation of the latter. He also composed some notable love songs. *Pron.* Feegay-eera.

Figueras. Town of Spain, in the prov. of Gerona. It stands in a fertile plain near the French frontier, 27 m. N.E. of Gerona on the Barcelona-Perpignan rly. The town is strongly fortified, with a citadel built by Ferdinand VI, which is considered a key to the frontier. There is important trade in soap, wine, leather, cork, and textiles. The town fell three times to the French—in 1794, 1808, and 1823. At the close of the civil war of 1936-39, following the fall of Barcelona, Jan. 26, 1939, the Spanish Republican government fled to Figueras, but the town was captured by Franco's forces on

Feb. 8, after a heavy toll of civilian life through bombardment. The last meeting of the Cortes was held here on Feb. 3, only 62 deputies being present out of 473. Pop. (1950) 16,589.

Figueras y Morācas, ESTANISLAO (1819-82). Spanish statesman. Born at Barcelona, Nov. 13, 1819, he studied law. As a republican he was elected to the Cortes in 1851. Prominent in the revolution of 1868, he strongly opposed all attempts to restore the monarchy, and upon the establishment of the republic of 1873 became president of the provincial council of ministers. He occupied a prominent position in politics until 1874, when the restoration drove him into retirement. He died at Madrid, Nov. 11, 1882.

Figurate Number. Term used in mathematics. In an arithmetical progression, if the first number is a unit and the successive numbers differ from it by whole numbers, as in such a series as 1, 2, 3, 4, 5, then a new series may be formed by adding together the first two terms, then the first three terms, then the first four terms, etc. The new series would thus be 1, 3, 6, 10, 15. These numbers are called figurate numbers. Similarly another series, 1, 4, 10, 20, 35, etc., might be formed from the second series.

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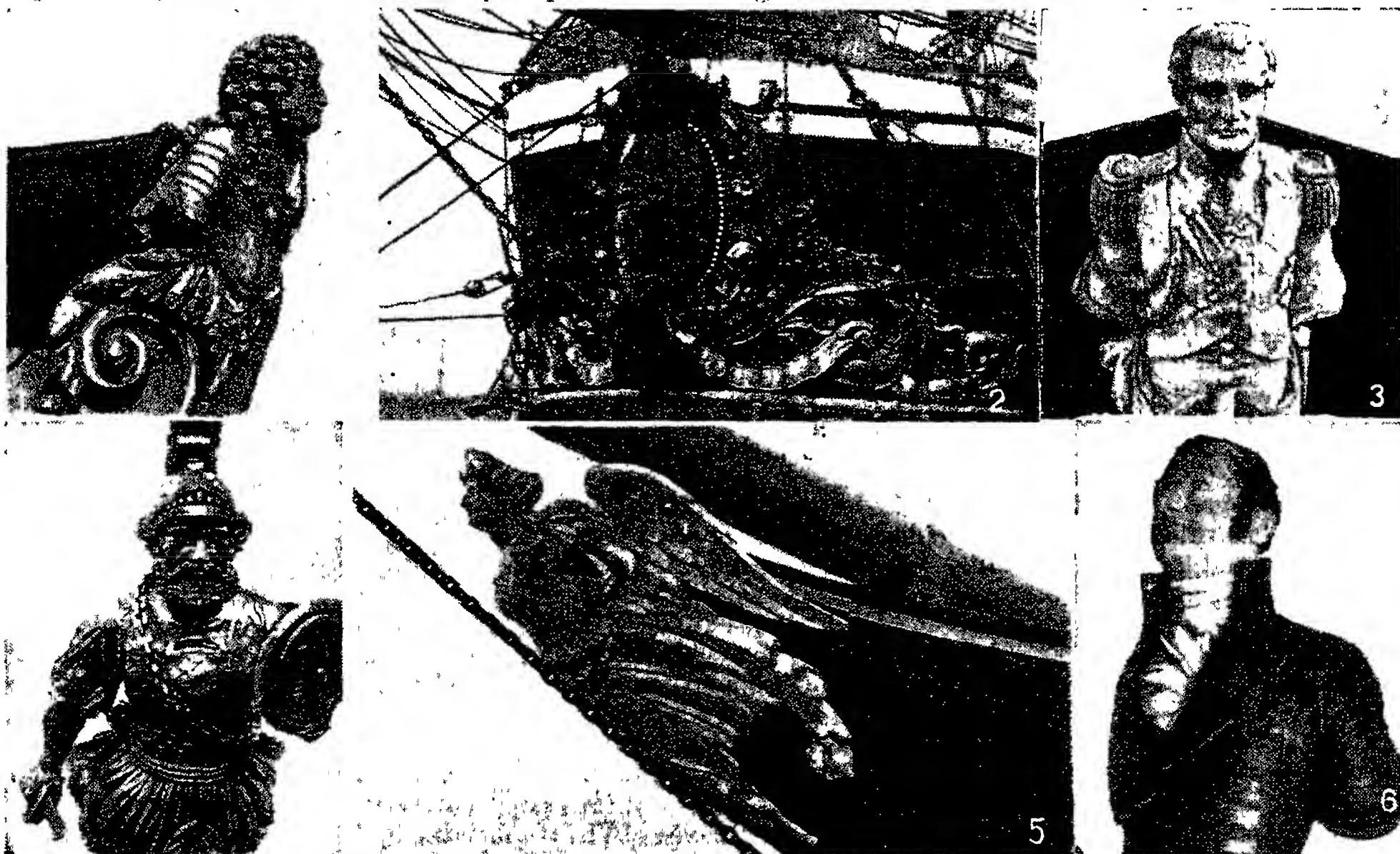


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Photos 1, 2 and 5, H. Symonds & Co., Portsmouth; 3, 4 and 6, Cribb, Southsea

Figwort (*Scrophularia*). Large genus of herbs, of the family Scrophulariaceae. They are native to Europe, Asia, N. Africa, and America. They have tuberous or creeping rootstocks and opposite leaves; the somewhat globular greenish-purple or yellow flower is succeeded by a two-valved capsule. As a rule they have an unpleasant odour. *S. nodosa*, the

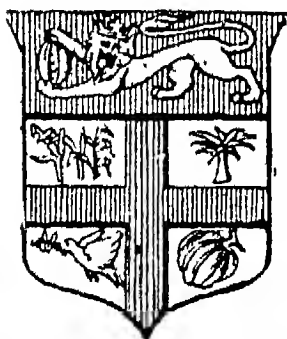


Figwort. Leaves and flowers of the knotted figwort

knotted figwort, is used by farmers to make a decoction for the cure of scab in swine.

Fiji Islands. British crown colony, sometimes called Viti Is. It consists of a group of about 322 islands and islets in the S. Pacific Ocean, most of which lie between lat. 15° and 20° S., and long. 175° E. and 178° W. Land area, 7,083 sq. m. About 106 islands are inhabited, but only three are large: Viti Levu (area 4,010 sq. m.), Vanua Levu (2,137 sq. m.), and Taviuni (217 sq. m.); smaller islands are Ovalau, Kandavu, Ngau, Koro, and Rotuma (which lies 400 m. N.W. of Vanua Levu). The remainder are islets and atolls bounded by reefs.

The islands are of volcanic origin, but beyond a few thermal springs there are no signs of recent activity. The larger islands are mountainous, rising to 4,000-5,000 ft., densely forested in parts (2,230,000 acres under forest), abounding in valuable woods, but the sandalwood for which the Fijis were formerly noted is almost exhausted. There are many good harbours and a few navigable rivers. The

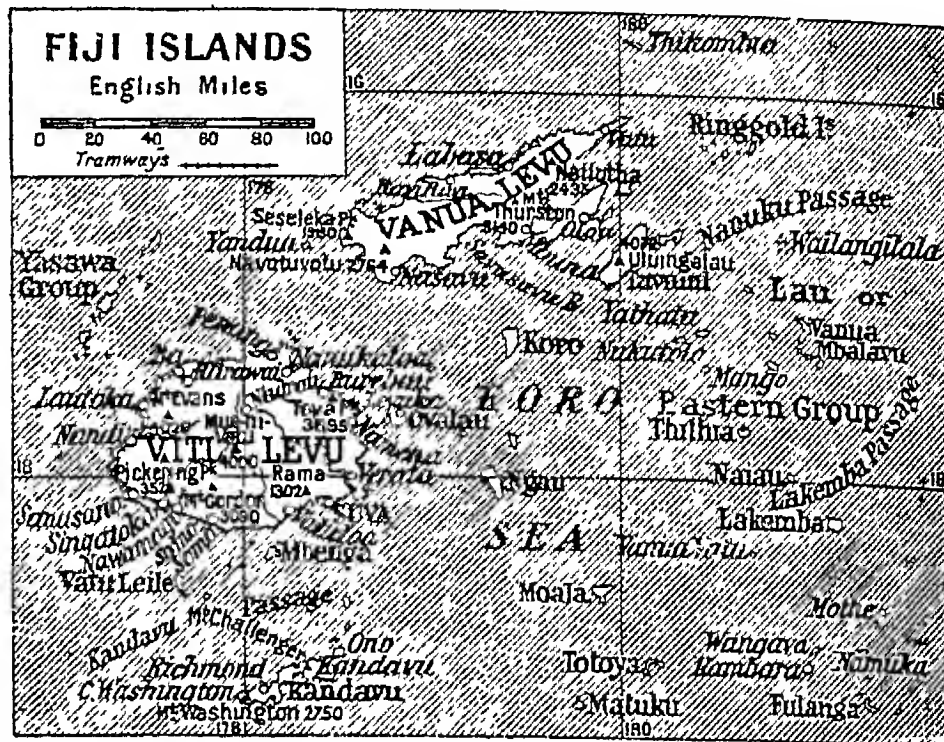


Fiji arms

climate is healthy and agreeable, the rainfall plentiful; the mean temperature is about 70°, and malaria is rare. The islands are subject to

hurricanes during Dec.-April. The soil is extremely fertile, the chief products being coconuts and copra, sugar, molasses, pine-apples, yams, bananas, maize, rice, tobacco, and turmeric; horses, cattle, sheep, pigs, and goats are reared. The chief exports are sugar, copra, fruit, and sici shell. The bulk of Fiji trade is with

British Commonwealth countries. Viti Levu has some 350 m. of roads and a narrow gauge rly. 380 m. long. Fiji is one of the principal air stations of the Pacific, visited by regular services from Australia, New Zealand, Canada, and the U.S.A. Communication between



Fiji. Map of the South Pacific islands ceded to Great Britain in 1874

peans numbered 6,402 and part-Europeans 7,810.

The Fiji Islands were discovered by Tasman in 1643; visited by Cook in 1769; ceded by the ruling chiefs to Great Britain Oct. 10, 1874. Under the constitutional arrangement of 1937 they are administered by a governor appointed by the crown, who is assisted by executive and legislative councils. A fair amount of self-government is allowed; local administrative units called *tikina* are under a Fijian of rank or special ability.

After the entry of Japan into the Second Great War in Dec., 1941, a Fiji defence force was formed. Fijian units served on Bougainville



Fiji. Native Fijian girl and (right) man, of Melanesian stock



the islands is chiefly by sea. There are a number of radio-telephone stations, and cable communication with Australia, New Zealand, and Canada. In 1954 there were 486 schools, 32 being under government control. Some 160,000 of the pop. were Christians (Methodism predominating); 130,000 Hindu; 28,000 Muslim. The capital is Suva (est. 1954 pop., 30,000) on the S. coast of Viti Levu.

A census of the population taken in 1956 gave the number of native Fijians as 148,134; the number of Indians as 169,409; while Euro-

and in other operations in the S.W. Pacific. The islands were used by U.S. troops as a training ground.

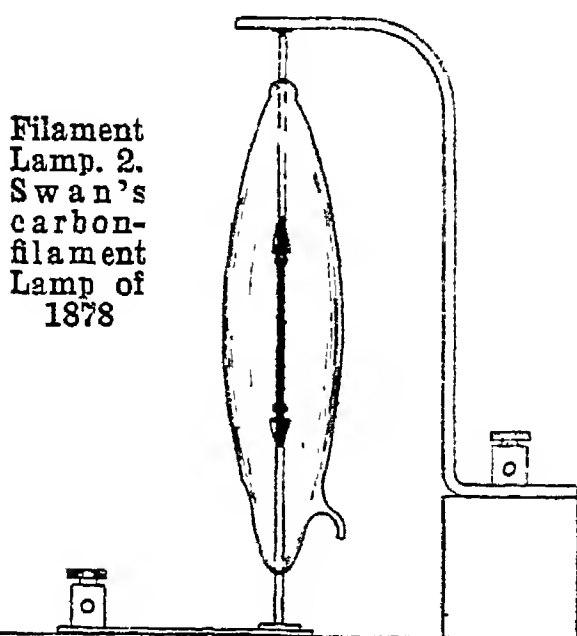
Filament. A high resistance tungsten wire in an electric lamp which becomes incandescent when current passes through it. In ordinary lamps the wire is wound in a close coil. In "coiled coil" lamps the coiled filament is again coiled on itself, giving a concentrated light source of high efficiency.

Filament Lamp. Before 1878 the arc lamp had the electric lighting field virtually to itself. This form of lighting, however, was available only in inconveniently large units, and the problem of "subdividing the electric light" was urgent. The obvious method was to develop heat in a filament; but whereas existing conductors could produce a great deal of heat without destroying themselves, they could not emit an economic amount of light. In 1845 Staite, an arc lamp engineer, exhibited a lamp with a platinum-iridium filament in a vacuum, but found that the metal was rapidly dissipated by evaporation at a temperature that did not give rise to a useful amount of light.

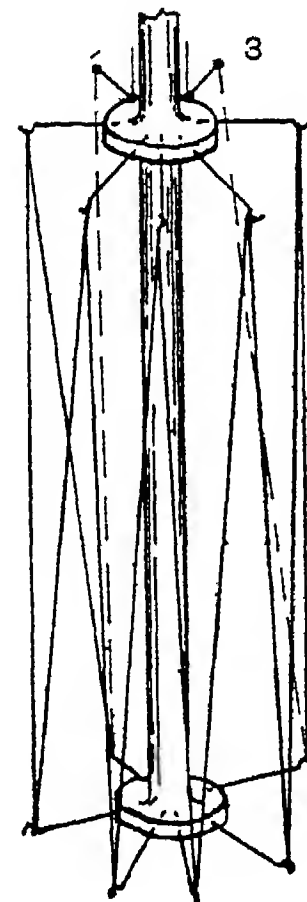
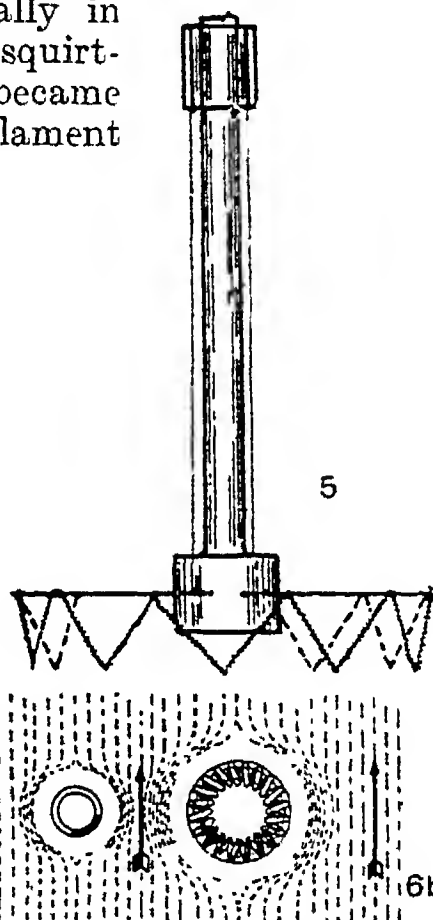
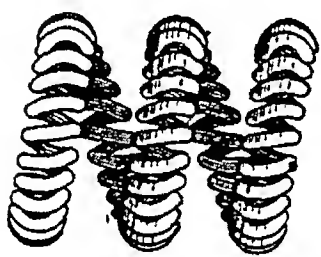
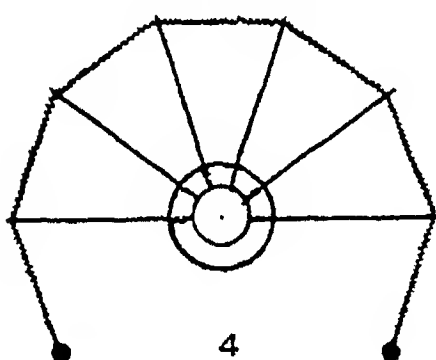
The curves in Fig. 1 illustrate the temperature requirements of a filament, showing the relative amount of energy radiated at the various wavelengths at four fixed temperatures. Since the only visible radiation is that between 0.4-0.7 microns, the small areas left shaded are alone useful for lighting purposes. Thus at 1,000° C. no light is given at all; at 2,000° C. only a small fraction of the total energy is useful; but further temperature rise causes a valuable increase in efficiency.

It was therefore necessary to find the material and the conditions of running that would permit the highest temperature to be maintained for a reasonable "life"; and 1,000 hrs. has always been regarded as the standard value for the latter. The chief requirement is evidently a high melting point; but all materials evaporate rapidly at temperatures well below this. The conductor with the highest melting point then known was carbon (3,500° C. as compared with 1,764° C. for platinum). Swan, who had seen Staite's demonstration,

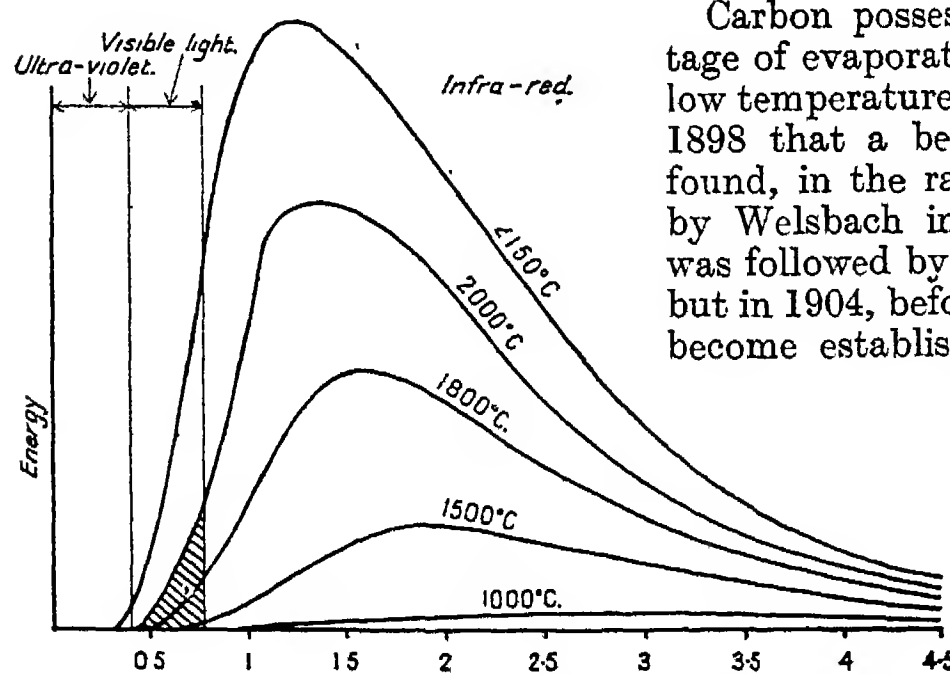
constructed a number of carbon-filament lamps from 1855, but no practical commercial model



till 1878 (Fig. 2). This lamp had a thin vertical rod of hard carbon, but about two years later he improved on this with a filament of cellulose drawn through a diamond die and carbonised. Finally in 1884-85 he developed the "squirting" process, which became the standard method of filament making everywhere.



Filament Lamp. Metal filaments: 3. Cage filament for vacuum lamps; 4. Wreath filament for small gas-filled lamps; 5. Festoon filament for large gas-filled lamps; 6a. Coiled-coil filament, greatly magnified; 6b. Comparison between coiled-coil, and coiled filaments, showing layer of inert gas around each



Filament Lamp. 1. Relative amounts of energy emitted by filament at various wavelengths in microns for 5 different temperatures. Energy used as visible light up to 2000° C. is shaded (see text)

Carbon possesses the disadvantage of evaporating at a relatively low temperature, but it was not till 1898 that a better material was found, in the rare metal osmium, by Welsbach in Germany. This was followed by tantalum in 1903, but in 1904, before the latter could become established, the tungsten filament (m.p. 3370° C.) was developed in America. At first it was "squirted" in the form of a metal powder mixed with a binder and then calcined or sintered, but Lang-

muir in 1906 discovered the process for wire-drawing the metal at a high temperature. The wire was wound between two molybdenum "spiders" in "cage" form (Fig. 3), and run in a vacuum of about 10^{-4} mm. of mercury. Its efficiency had reached about four times that of the carbon lamp.

In 1913 evaporation was reduced by replacing the vacuum with a filling of inert gas, argon mixed with about 10 p.c. of nitrogen being found the most effective. To minimise convection loss, it was now necessary to concentrate the filament, by making it in the form of a closely wound spiral, which was supported as a horizontal wreath for the smaller lamps (Fig. 4), or festooned in a series of Vs (Fig. 5) for the larger. A whiter light was the result, with an efficiency about seven times that of the carbon lamp. A further improve-

ment was effected in 1936, by coiling the already coiled filament, as shown in Fig. 6a. This added a further 20 p.c. to the light output, making it about eight times that of the carbon lamp.

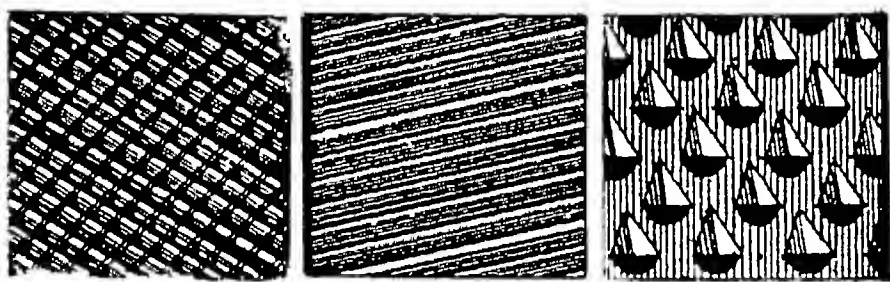
Filament lamps should be run at their correct voltage. If this is exceeded by 10 p.c., 38 p.c. more light is given, but the life falls to 300 hrs. instead of 1,000. Lamps for projection purposes are designed to run at about this intensity.

Filangieri, GAETANO (1752-88). Italian lawyer. The son of Caesar Filangieri, prince of Arianiello, he was born at Naples, Aug. 18, 1752, and became a lawyer. He is chiefly known for his work, *The Science of Legislation*, which secured a

European reputation. This is unfinished, only four out of its six books being completed; it deals with legislation, economics, and education, and shows its author as a thinker much in advance of his time. Filangieri passed much of his life in Spain, where he held appointments at court, and died at Vico Equense, July 21, 1788. The *Science of Legislation* was translated into English by Sir R. Clayton, 1806.

Filangieri had a son, Carlo (1784-1867), famous as a soldier in the French service. He began his career under Napoleon and saw service at Ulm, Austerlitz, and elsewhere. His name is chiefly associated with Sicily; in 1848 he was sent there by Ferdinand II, king of Naples, to subdue the rebels, and he remained in the island as governor until 1855. In 1859 he was made prime minister by Francis II, king of Naples, but he soon resigned because his suggestions for a more liberal form of government were rejected. Made prince of Satriano, he died Oct. 9, 1867.

Filaria (Lat. *filum*, thread). Genus of Nematode or threadlike worms, many of which are parasitic in the bodies of man and other animals. Certain of these minute worms are the cause of various diseases, most of them peculiar to tropical countries. *Filaria bancrofti* lives in its adult stage in the lymphatic glands, while its embryos, *Microfilaria sanguinohominis*, are found in the blood.



File. Left, double-cut rough file; centre, single-cut rough file; right, horse rasp, showing burrs

It is conveyed by the bite of a mosquito, and is the cause of elephantiasis and haematuria. Pathological changes are due partly to mechanical blockage of the lymphatics, and partly to toxins elaborated by the worms and to secondary invasion by streptococci. *Filaria medinensis* is known as the guinea worm, and encysts under the skin of the back and legs, forming subcutaneous abscesses. The larval stage is passed in the cyclops, and the larvae probably conveyed to man by impure drinking water. See Tropical Diseases.

Filariasis. Disease caused by infection with a nematode worm belonging to the family Filariidae. Several genera and species are

recognized, but by far the most important is the *Filaria bancrofti*. See Elephantiasis.

Filbert. Fruit of the cultivated hazel. In it the leathery husk is greatly extended so as to conceal the nut. Its proper name is Philibert nut, so called from S. Philibert, whose day is kept Aug. 22 during the height of the nutting season. See Hazel.

Fildes, Sir (SAMUEL) LUKE (1844-1927). British artist. Born

at Liverpool, he studied at Chester, South Kensington, and the Academy schools. He began his career with black and white work for *The Graphic*, contributing a sketch of Casuals for the first number, 1869; this was, in 1874, the subject of a popular picture at the R.A. He illustrated Dickens's *Edwin Drood* in 1870. *The Doctor*, 1892 (Tate Gallery), set the seal on Fildes's reputation as a painter of sentimentally pathetic subject pictures. In 1901 he painted the official portrait of Edward VII, and in 1905 that of Queen Alexandra. He was elected A.R.A. in 1879 and R.A. in 1887, and knighted in 1906. He died Feb. 27, 1927.



Russell

File. Hand tool used for shaping and smoothing metal. Files are also used to sharpen saws. Many varieties are used: flat, taper, round, square, three-square or triangular, half-round, and rat-tail or tapered round. In flat files both faces

and edges may be cut; if one edge is left smooth the file is said to have one "safe-edge." The best files are made of the finest crucible cast steel; the cutting edges are formed by means of a short chisel, held at an angle on the "blank," as the uncut shape is called, and struck with a hammer. A rasp is a file in which a series of strong burrs are made by a pointed punch.

Standard files are single cut or double cut. The cutting begins at the point of the file and advances by steps according to the intended fineness of the file. After the first cutting is finished, if the file is to be double cut, it is gone over again with the chisel held so as to cross the former cuts at an angle. Cutting surfaces of files are distinguished in a complete series as rough, middle cut, bastard, second cut, smooth, and dead smooth. The sizes range from a watchmaker's tool, about three-quarters of an inch long, to files three feet in length. "Swiss" files of super-hard steel have long held the field for jewellers' and watchmakers' work, making precision instruments, etc. Most files are provided with a "tang," a pointed end intended to be driven into a wooden handle. Files are cut while the blanks are in the soft or annealed state, and are afterwards hardened, great care being taken to avoid distortion of their shapes. Skill in filing, the ability to file a surface flat, is still the hall-mark of a good mechanic; though machine tools have somewhat diminished the importance of the art.

File (Lat. *filum*, thread). Military term for soldiers formed up behind one another. In the British army men fall in in three lines; those abreast form the ranks; each man in the front rank with the men immediately behind him forms a file. When numbered off, the front rank man numbers for his file. If the total of the men in the squad is not divisible by three, the last file but one, known as the blank file, has only one or two men.

File Fish. Member of the genus *Balistes* of the order *Plectognathi*, an order of sea fish.

Filey. Urban dist. and seaside resort of the East Riding of Yorkshire, England. It is 7½ m. S.E. of Scarborough on the railway, and is pleasantly situated on the cliffs



Filey. Filey Brigg, principal feature of the coast at this Yorkshire holiday resort

By courtesy of British Railways

overlooking Filey Bay. It possesses a fine stretch of firm sand, a good promenade, and golf links. Here is also situated a large permanent holiday camp. Filey Brigg, on the N. part of the bay, is a ridge of sandstone stretching $\frac{1}{2}$ m. out to sea. S. Oswald's, a cruciform building, partly of Norman work, partly Early English, is the chief church. Until recently the boundary between the E. and N. Ridings of Yorkshire separated this church from the town proper. A gunnery school and infantry training centre were established for the R.A.F. Regiment at Filey during the Second Great War. Pop. (1951) 4,764.

Filibranchiata. An Order of molluscs belonging to the Lamelli-branchiata, often called the bivalves. Members of this order have filamentous gills.

Filibuster. Term, probably of Dutch origin, originally applied to the buccaneers or 17th century pirates infesting the Spanish-American coasts and later to the irregular adventurers who organized expeditions in Spanish-American revolutions; *e.g.* Lopez against Cuba (1850-51), Walker against Nicaragua (1855-60). Metaphorically it denotes a member of an American legislature who attempts, either singly or as one of a group, by means of tactics permitted under its rules of procedure, to prevent or delay the passing of a resolution approved by the majority. In the U.S. senate in 1908 Senator La Follette spoke continuously for 18 hours against a currency bill, and in 1935 Senator Huey Long for 16 hours against the extension of the National Industrial Recovery Act.

Filigree (Lat. *filum*, thread; *granum*, grain). Form of decorative work carried out with fine wire of gold, silver, or copper. It has been used for jewelry and ornament from prehistoric times, sometimes alone, sometimes in combination with solid metal, enamel, and precious stones. The Etruscans and later the Byzantines combined filigree work with granulation—a type of decoration consisting of small and large balls. In early work the dainty wire patterns were attached to metal plates, and when the space between was filled with enamel it was known as filigree enamel. Treatment varies a good deal. Indian work is mostly floral, very thin wire filling in the space between the outline of thicker flattened wire. Maltese filigree is like cobwebby lace, as is much from Portugal.

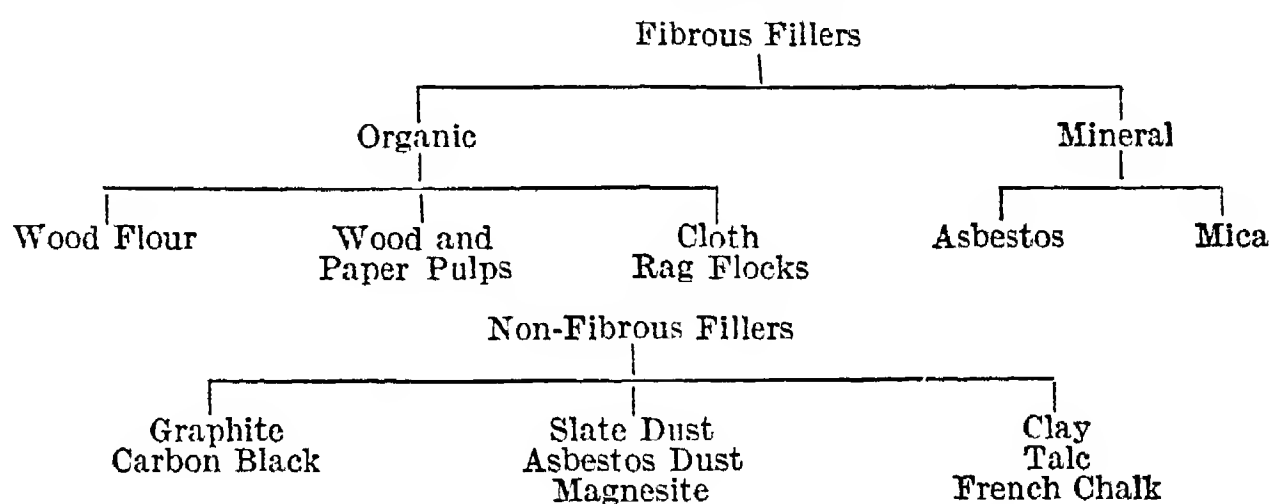
Apart from its use for articles for personal adornment, filigree decoration was used in medieval times to embellish reliquaries, and, from this, detached lacework in Gothic architecture is sometimes called filigree work. (*See Byzantine Art*, illus. p. 1609.)

There are two types of filigree glass : (1) interwoven or spirally twisted clouded or coloured threads embedded in the glass ; (2) surface decorations or other ornaments carried out in glass threads.

Filipinos. Name of the native inhabitants of the Philippine

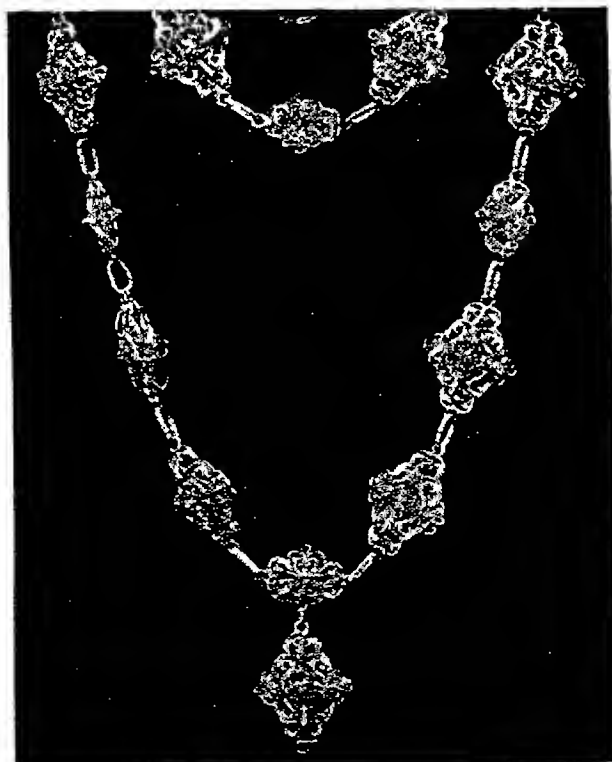
Filler. A word used in several senses, *e.g.*, a vessel for filling others; a man who fills barrows or trucks with excavated material in preparing ground for building and civil engineering works; and especially any packed material surrounded by wrapping.

More important is the use of the word to include fillers or extenders used in manufacturing processes to impart strength, durability, resistance to abrasion, good electrical properties, etc. The table shows a useful classification of fillers of this kind.



Islands (*q.v.*). The Filipinos belong to tribes of Malayan stock. The Liga Filipina was founded about 1890 by Dr. José Rizal (*q.v.*) with the object of securing more freedom for the inhabitants than they then had under Spanish rule, and subsequently the term Filipino came into general use.

Fillan (d. c. 777). Scottish saint. According to the Aberdeen breviary, he was the son of S. Kentigern, and early in life became a monk. He lived for some years in a cell near St. Andrews, where he was later elected abbot. He retired to Glendochart in Perthshire, where he founded a church. He was buried at Strathfillan. His festival is on Jan. 9.



Filigree. Gold necklace of sixteenth century Venetian work

By permission of the Director, Victoria
& Albert Museum, South Kensington

Most of these fillers are found useful in the manufacture of paper, plastics, paints, hard rubber, etc.

Barytes, chalk, china clay, gypsum, talc, silica, and slate dust are used as fillers in paint, not solely for the purpose of cheapening it but to improve its general qualities, notably durability. In paper-making, loading with such fillers as barytes, whiting, or titanium oxide, assists the production of a high degree of whiteness and opacity.

In the rubber industry (e.g. rubber tires), zinc oxide, carbon black, lamp black, and occasionally whiting and fossil meal increase durability, resilience, and resistance to weathering.

Synthetic resins and plastics, particularly of the bakelite type, mixed with such fillers as asbestos fibre, cotton flocks, wood flour, and mica, yield a powder which can be filled into the moulds of heated presses. Under the influence of heat and pressure the resin liquefies and, with the filler, bonds into an infusible form with great mechanical strength, good electrical properties, resistance to heat and temperature changes, and unaffected by moisture and solvents.

Vulcanised rubber for the electrical industries may be compounded with mineral fillers according to requirements. Powdered cork in linoleum; whiting and powdered graphite in solid lubricants; and mineral sub-

stances for loading certain textiles are other instances of the use of fillers.

H. M. Langton

Fillet (Old Fr. *fillet*, little thread). Term in architecture, signifying a narrow moulding or flat band in a moulding. It is also used to indicate the flat ridge between the flutes of a shaft. See Fluting; Moulding.

Fillmore, MILLARD (1800-74). President of the U.S.A. Born Feb. 7, 1800, in New York state, the son of a settler, he had a rough boyhood. Apprenticed to the cloth trade, he began to study law, and earned a livelihood by teaching at Buffalo until qualified to practise. This he did at Aurora, where he was soon the head of a prosperous firm. In 1829 he entered the legislature of New York. In congress he sat as a Whig, 1833-35 and 1837-43, becoming a prominent speaker in the house of representatives. In 1848 he was chosen vice-president, and on July 9, 1850, on Taylor's death, he succeeded to the presidency.

On the slavery question Fillmore was a moderate. On the one side he pressed forward in 1850 the fugitive slave law and other measures of compromise; on the other he had supported legislation for preventing the extension of slavery outside the existing slave states. But the Whigs declined to put Fillmore forward again; when he stood for president, 1852, only one state supported him; and his term ended March 4, 1853. He died at Buffalo, March 8, 1874.

Film. A flexible material used in photography in place of glass plates as the support of the sensitive emulsion in the making of negatives. The advantages of film are reduction of weight and the facility of loading the camera and developing the negatives without a dark room, and non-liability of the negatives to breakage when stored. Celluloid was formerly almost exclusively used as flexible support, but has now been largely replaced by an acetate base which is non-inflammable. Paper is employed in some recording instruments such as oscillographs and cardiographs. The sensitive film is generally used as a long band backed with a longer band of black paper, wound together as a spool or bobbin. The extra length of paper at each end allows of the spool's being inserted in one chamber of a film camera, and then of the film's being wound on to a second but empty spool after exposure. Owing to the enveloping black

paper both operations can be done in full daylight, and material for any number of photographic subjects can thus be carried and used without a dark room. In the miniature film cameras using 35-mm. perforated film, the paper backing is dispensed with, the film being loaded into a light-tight cassette which is inserted in the camera from which it passes into a similar holder or is rewound into the original cassette before removal from the camera. A limited use of unbacked film is also made in other sizes of specially designed cameras. The so-called "daylight loading" of film cameras was introduced commercially in 1891 by the Eastman Kodak Co. for the Eastman roll-film introduced in 1889. Emulsion-coated film of stiffer substance is also used in cut pieces, and is handled in the same way as dry plates.

FILM PACK. This is a carton of cut films placed one behind the

other, each with a protruding paper tab attached and so arranged that by drawing out the appropriate tab the film which has been exposed is drawn round to the back, leaving the next film in position for exposure. The film pack is a daylight loading device and is placed in the camera in a special adaptor which replaces the usual dark slide. A film strip is a strip of perforated film 35 mm. wide of the type marked as safety, carrying a series of photographic images adapted for optical but not for cinematographic projection. It is not bound between glass or other protective medium. The usual size of each frame is 36 mm. long by 24 mm. wide. The film strip has largely replaced sets of lantern slides for educative and instructional purposes. A film strip projector is an optical lantern, automatic or semi-automatic in action, specially designed for the projection of film strips.

FILM: A 20TH-CENTURY ART FORM

This article examines the varied types of entertainment and information which moving pictures provide. For the scientific, technical, historical, administrative, and legal aspects of the industry, see Cinematography

In the cinematograph trade the word film is generally used in the U.K. not only for the photographic film itself but for the sequence of pictures as projected from that film on the screen, being thus analogous with a play or a novel, and therefore suitable for consideration as a work of art. The corresponding American term is motion picture or "movie."

The earliest cinematograph films, in the late 1890s, were content with the wonder of recording mere incidents of movement of the "train coming into a station" kind. These simple experiments were the historical basis of a highly developed art, the later additions of sound and colour having only enlarged the scope of the same art, the essence of which is to awaken particular impressions and responses by the creation of an illusion of reality within its own conventions, the chief means of illusion still being movement.

The simplest form is seen in the news film, which was originated as early as 1896 with a film of the Derby shown in London on the evening of Derby day. Most cinemas include in their programme a series of brief topical films, a spoken commentary usually supplementing such sounds as were actually recorded with the taking of the pictures. The items

filmed are almost always pre-arranged public events and sporting occasions. Only rarely is a film camera fortunate enough to pick up an unexpected item of news, though this has sometimes happened either through intelligent anticipation or through luck, as in the filming of the 1913 Derby when a camera at Tattenham Corner recorded the tragic incident of Emily Davison throwing herself in front of the King's horse, or when the screen was able to show clearly that a goal in the 1932 F.A. Cup final was kicked from the wrong side of the line.

Closely allied to the news films are the topical feature films, including fashion displays and personal interviews, and the so-called "travel" films, which are in effect conducted tours in unfamiliar parts of the world. The latter were first popularised during the opening decade of the 20th century by such enterprises as Hale's Tours of the World. Travel films, like nature films, form a considerable proportion of those designed primarily for educational purposes, which also include those which illustrate by the aid of animated diagrams various branches of science.

A variation of informative feature film was seen in the American series, *The March of Time*, which,

beginning in 1935, led the way in the judicious selection of factual camera shots to give point and purpose to a single topical theme. A more purposeful exploitation of "the creative treatment of reality" was the "documentary," as developed by John Grierson and other film-makers in the late 1920s. These records of life and industry are based on factual material but use an imaginative interpretation of the subject. They can focus on high lights and striking contrasts, and may reveal an underlying rhythm to which the music and spoken commentary of the sound track give emphasis.

Tricks and Devices

In a class by themselves are what were once known as trick films, using to the full the camera's power of illusion in startling or amusing ways, *e.g.* by double exposure, backward projection, ultra-slow or ultra-rapid exposure. Though the trick film as such has become a rarity, its devices have been fully employed in other types of films, from the "slow-motion" informative film revealing the full grace of athletic movement and the "rapid motion" educational film (*e.g.* showing the growth of flowers) to the use of illusory effects in fantastic films like *The Invisible Man*, *Blithe Spirit*, or *A Matter of Life and Death*. Very early films of this type were made by a French director, Melies, *e.g.* *A Trip to the Moon* (1902). Other often-used devices, or tricks, include the superimposing of background scenery, the use of small scale models, and the "doubling" of a star actor's part for the more violent kind of incident; also such methods of switching from one scene to another as the "fade," the "dissolve," and the "wipe," terms which explain themselves.

The trick film was also the parent of the animated cartoon, which brings drawings to life. Cartoons date from 1908, when Cohl made his *Phantasmagoria*. Their popularity was ensured with the invention of Pat Sullivan's *Felix the Cat* in 1917. With the coming of sound the foremost place in this field was taken by Walt Disney, first with *Mickey Mouse*, then with the *Silly Symphonies* and such ambitious full-length cartoons as *Snow White* and the *Seven Dwarfs*. Film-makers in many countries—notably U.P.A. in the U.S.A.—subsequently developed the animated cartoon to still greater subtlety and sophistication.

But by far the majority of films made are dramatic narratives (or photoplays, as they are called in the U.S.A.) enacted by professional actors from specially prepared scripts with a background, as often as not, of specially made scenery; and subsequently collated and given continuity and shape by expert editors. The primary purpose of such films is to entertain. Sometimes the stories are new; sometimes they are adapted from existing novels and plays. The source of origin of a film story does not in itself appear to affect either its box-office success or its worth as a work of art.

For better or worse, the general standards of film story, as well as those of acting and technical accomplishment, were set by the U.S.A., which obtained virtually a world monopoly in film production during the First Great War, and maintained its commanding commercial position for many years, Hollywood becoming the world centre of the film industry. For too long the general artistic level remained low. The box-office came first, and the average Hollywood silent film, designed to appeal to the uneducated masses throughout the world, was based either on sentimental romance, equivalent to that found in cheap novelettes, or on crude sensationalism. Humour, having a universal appeal, received a better showing, especially as an artistic genius in Charles Chaplin was found to show the way. But of wit, of intellectual content, of intelligent appreciation of human problems, or of insight into any but the most superficial human emotions, there was almost nothing. Technical achievement was immense, artistic achievement negligible.

European Developments

European countries approached the new art more seriously. The U.F.A. productions of Germany during the 1920s were in advance of their time, and their experiments in reflecting the researches of the psycho-analysts, as seen in such films as *The Cabinet of Dr. Caligari* (1919), attracted attention no less than their bold experiments in novel photographic "angles," unusual lighting, and atmospheric suggestion. Later German films, *e.g.* *Mädchen in Uniform*, *Westfront, Emil and the Detectives*, *The Captain of Köpenick*, were revolutionary in their delineation of character, their development of dramatic tension,

their accuracy in psychology. The experiments were abruptly ended in 1933 with the seizure of power by the Nazis.

France evolved a highly individual style of film drama, distinguished by a spritely and mordant wit, seen at its best in the early films of René Clair, *e.g.* *Sous les Toits de Paris* (1930) and *Le Million* (1931), but echoed in such later films as *La Kermesse Héroïque* (1936), *Un Carnet de Bal* (1937), *La Femme du Boulanger* (1939), and *Les Enfants du Paradis*, which was made during the German occupation. These memorable German and French films were made at trifling cost compared with the huge sums expended by Hollywood; nor were they great commercial successes.

Where British Films Excel

For some years after 1918 British film drama was mainly content with imitating the conventions of Hollywood. Such directors as Alfred Hitchcock, Anthony Asquith, and Alexander Korda were the first to establish artistic standards which were more satisfactorily indigenous, and by 1939 British films were ready to challenge comparison at least in quality with Hollywood products, whatever they lacked in quantity. A particularly happy vein was discovered in historical and biographical subjects, demanding a blending of accuracy in factual detail with imaginative treatment of character. A good example of this was Korda's *The Private Life of Henry VIII* (1934). Another British characteristic that has lent itself to successful treatment in British films is an affection for the authentic recording of familiar scenes and objects of daily life in and around the homes of ordinary people. British directors have been able to discover the stuff of appealing film drama in buses, trains, bicycles, motor coaches, suburban shops, village inns, factory canteens, humble breakfast tables, back yards, air raid shelters, and even, as in *Hue and Cry* (1947), the bombed ruins of London. One need search for examples no farther back than *Millions Like Us* (1943), *Tawny Pipit* (1944), *Waterloo Road* (1944), and *Brief Encounter* (1946). In place of the Hollywood formula of stock figures in startling surroundings, many of the best British films have offered all the rich oddities of native character against a background that is deliberately humdrum. The great heritage of English literature and

English drama, from Shakespeare to Shaw, provides another field for the British film which, in spite of isolated successes, has scarcely begun to be tapped.

That the Hollywood standards have slowly improved, however, becomes obvious if the list of awards of the American Academy of Motion Pictures, Arts and Sciences, is studied from its inception in 1927. The list includes *All Quiet on the Western Front* (1930), *The Life of Emile Zola* (1937), *Gone With the Wind* (1939), *Gentleman's Agreement* (1947), *All the King's Men* (1949), *All About Eve* (1950), *An American in Paris* (1951), *Marty* (1955), *Around the World in 80 Days* (1956). To this list might be added *Mr. Deeds Goes to Town* (1936), *Green Pastures* (1936), *Louis Pasteur* (1936), *Citizen Kane* (1941), *The Best Years of Our Lives* (1946). Moreover, from the coming of sound films and the consequent elimination of mere miming, American film actors, in spite of intense "off-stage" publicity, quickly schooled themselves to a natural style of acting which took British actors a whole decade to emulate. Hollywood's pre-eminence in the making of elaborate musical films remains unchallenged. So do the American comic films; there have been no British equivalents of the Marx Brothers, Laurel and Hardy, or Abbott and Costello.

Compared with the stage, the film has proved itself to be unlimited in its range of subject. It can annihilate time and space, can portray a man's innermost thoughts, show a thousand actors at once or reveal the almost imperceptible twitch of an eyelid. With equal ease it enables the spectator to follow a procession through the streets of modern London or across the deserts of ancient Egypt. From the camera the spectator borrows an all-seeing eye; and among other things that eye cannot fail to catch many glimpses of beauty. The all-seeing eye moves rapidly. Shakespeare's *Romeo and Juliet* is divided into 22 scenes. Thalberg's film version had over 260, many of them no more than momentary. There were 239 separate camera scenes in *The Private Life of Henry VIII*.

The life of a film is short but intense, for it can be seen simultaneously in every part of the world. In Great Britain its life usually consists of a preliminary run at one or two cinemas in the

west end of London, followed immediately by a general and almost simultaneous release to the suburbs and provinces, where it is seen for no more than one week, and seldom again. After this it is assumed that everybody who wishes to see it has done so. A few cinemas specialise in the re-showing of earlier favourites, but general revivals are reserved for only a few films. The British Film Institute, through the National Film Archive, created a valuable collection of films and through the National Film Theatre, London, provides opportunities of seeing a range of film classics.

Social and Moral Influences

This powerful art form has been made the medium for information, education, commercial advertising, propaganda (especially in the U.S.S.R., which nationalised its film industry in 1919), and, above all, entertainment. The extent of its social and moral influence has been debated from the very outset, ever since the exhibition in 1896 of a film called *The Kiss*. Much has been heard of the harmful influences of "the pictures": it is in the nature of things that any beneficial influences should remain unstated and incalculable. The moral effect of watching gangsters at work may well be balanced by that of watching policemen at work. Voluntary censorship on both sides of the Atlantic protects the public from certain excesses. For the rest, all that can be said with certainty is that the film-going habit has become deeply ingrained among many millions of the world's inhabitants, and that any improvement in the artistic standards of the commercial film is a sure reflection of improvement in public taste and public demand. See *Censorship*.

Gordon Stowell

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Film Censors, BRITISH BOARD OF. Organization established by the British film industry to formulate and administer a code of voluntary censorship of films produced or exhibited in Great Britain. The first president, G. A. Redford, was succeeded in turn by T. P. O'Connor, Edward Shortt, Lord Tyrrell of Avon, and Sir

Sidney Harris. The board has no legal power to enforce its code, but an exhibitor who offends may have subsequent supplies of films withheld, while a producer who offends may be refused facilities for exhibiting. A film banned by the board is not necessarily excluded from public exhibition: a local authority may decide that it may be exhibited. Also there is no control over films exhibited by private film societies.

The policy of the board is designed to safeguard morals, eschew politics, and to avoid the cruel or vicious in life. Films are not passed for exhibition if they include scenes depicting cruelty to animals; nor are films which might offend religious susceptibilities. Until May 10, 1941, when the building was destroyed, the headquarters of the board was at Carlisle House, Soho, built by Wren in 1670. See *Censorship: Hays Office*.

Filmer, SIR ROBERT (d. 1653). English political writer. Educated at Trinity College, Cambridge, he was a staunch royalist, and suffered much during the Civil War. His political treatises, mostly published posthumously, are of an absolutist character, defending the patriarchal theory of the origin of government, and attacking the doctrines of Hobbes, Milton, and others. The most important is *Patriarcha*, published 1680 and to which Locke replied in his *Treatise on Government*. Filmer died May 26, 1653.

Film Institute, THE BRITISH Organization set up in 1933 to collect information, promote cooperation between teachers and the film industry, advise govt. depts. and schools on production and use of films, encourage research, and maintain a national film library. It receives an annual grant, at first derived from the Sunday cinematograph fund, later direct from the treasury, and has a board of governors representing govt. depts., educational bodies, and bodies connected with the film industry. Its h.q. is at 164, Shaftesbury Avenue, London, W.C.2.

The National Film Theatre, London, established under the auspices of the Institute in a specially constructed temporary building as part of the Festival of Britain, 1951, continued to show films of special interest, British and foreign, old and new. Construction of a permanent building started in 1957.

Filmy Fern. Ferns of delicate texture belonging to the genera *Trichomanes* and *Hymenophyllum*.

The leaves are so thin in substance that they are more or less pellucid, and lose moisture so rapidly that they are found growing only where the atmosphere is humid. Consequently in cultivation they require to be kept in a closed case. The filmy ferns proper form the genus *Hymenophyllum*, of which *H.*



Filmy Fern. Leaves of *Hymenophyllum tunbridgense*

tunbridgense is a well-known European form, with leaves only two or three inches long, growing in matted sheets on moist, shaded rock. The Killarney fern (*Trichomanes radicans*) is larger, with leaves as much as a foot long.

Filon, PIERRE MARIE AUGUSTIN (1841–1916). French author. The second son of the historian, Charles Auguste Filon (1800–75), in 1867 he was appointed tutor to the Prince Imperial, only son of Napoleon III, and after the Franco-Prussian War he accompanied the prince to England. He died at Croydon, May 13, 1916. Besides numerous studies of English life and literature contributed to French reviews, his voluminous works include *Guy Patin*, *Sa Vie et Sa Correspondance*, 1862; *Histoire de la Littérature Anglaise*, crowned by the Academy, 1883; *Nos Grand-Pères*, 1887; *Prosper Mérimée*, 1898; *De Dumas à Rostand*, 1898; and *La Caricature en Angleterre*, 1902. His son Louis (1875–1937) became a leading English mathematician.

Filter. Device for removing suspended matter from fluid. When matter is removed from a fluid by passing through a medium having holes smaller than the particles, for instance through wire gauze or perforated metal, the medium is a strainer rather than a filter. A filter proper may have holes very much larger than the particles removed, separation being effected by the trapping of the particles in the angles, narrow channels, and corners of the mass of the filtering body. In general, the greater the

thickness of the filter, the finer the filtration; a large thickness of a coarse body has the same effect as a smaller depth of a finer body; *e.g.* a layer 3 ft. deep of fine sand is equivalent to a layer one-eighth of an inch thick of fine kieselguhr.

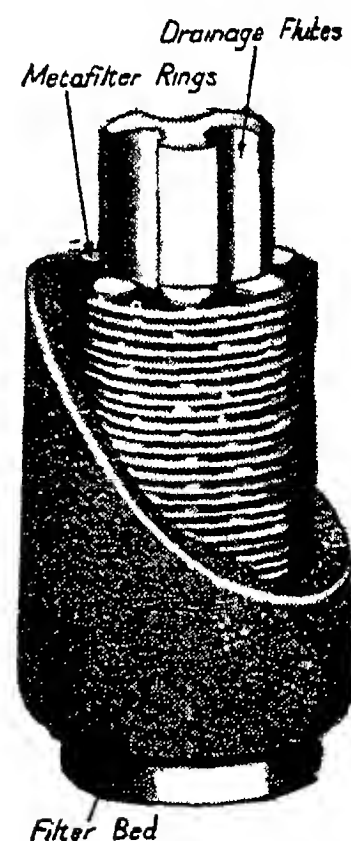
A filter may take the form either of a sheet or of a mass of granular material held in a container. The commonest materials used as sheet filters are paper, cloth, porous stone, asbestos sheet, and sintered materials. Typical loose materials used as filters are sand, carbonate of lime, paper-pulp, powdered charcoal, kieselguhr, asbestos.

SAND FILTERS. Used mainly for the filtration of water, these are of three types: (1) slow sand filter, which is a layer of sand 2–3 ft. thick above a layer of gravel 1–2 ft. thick, covering often many acres. Water percolates through under gravity and is then pumped away. A rate of 1 to 2 gallons per sq. ft. per hour is usual; (2) rapid sand filter—a layer of sand in a large concrete open tank, used mainly for the preliminary purification of water from mud; it gives only a moderate degree of filtration; (3) pressure sand filter: in this, hydrate of aluminium is generally used in conjunction with the filter bed, which is enclosed in a cylindrical tank into which the water is pumped under pressure; a flow of 100 gallons per sq. ft. of filter surface per hour normally is attained. The filtering medium is fairly fine sand, and the pressure used does not in general exceed 20 lb. per sq. in. This type of filter is suitable for swimming baths and industrial installations.

CLOTH FILTERS can be classified under the following headings: (1) filter press (*v.i.*); (2) rotary filter, the usual type of which is a horizontal drum divided into separate sector compartments, the curved surface being covered with filter cloth. The filter is mounted to rotate on its longitudinal axis half submerged in the liquid to be filtered. As each section becomes submerged a valve puts it into communication with a vacuum pump which draws the liquid through the cloth surface, leaving the solid to form a cake on the outside. When in the course of the rotation the section emerges from the liquid the suction is continued to dry the cake, and sometimes wash water is applied at this point. Before the drum completes a revolution, the cake is scraped off by a stationary knife, or blown off, or otherwise removed, and the cloth surface thus cleaned is ready

for another cycle; (3) bag filter: this usually consists of a number of bags, each about 6 ft. long and 9 ins. in diameter, their necks tied each to a short pipe by which liquid enters the interior of the bag from a tray supplied with the liquid to be filtered. Each pipe fits tightly into a hole in the bottom of the tray. This filter is effective in removing slimy deposits where high pressures are inadmissible; (4) gravity filter, which consists of cloth bags with a drainage frame inside them. Several are supported in a closed tank to which liquid is supplied under a pressure of 10 to 20 ft. gravity head. The liquid flows through the cloth into the centre of the bag and a nipple provides an outlet through a liquid-tight joint to the outside of the tank, where the filtrate is collected in a gully.

There is a very large variety of filters using finely porous material such as unglazed porcelain, compressed asbestos, compacted kieselguhr, or edge-filtration through paper. The "Metafilter" (Fig. 1), suited to fine clarifications of many different types, is a combination of

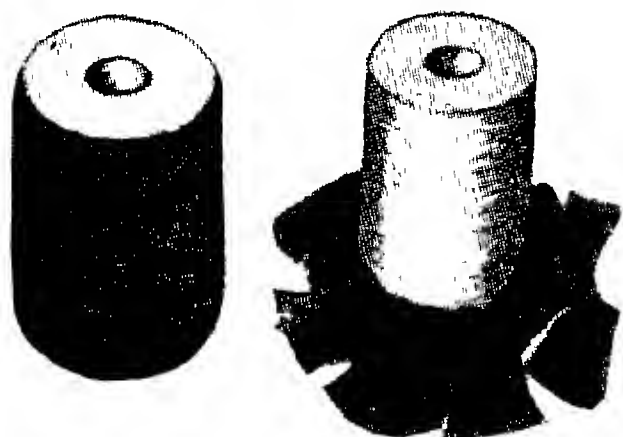


Filter. Fig. 1. Metal edge filter which uses the spaces between a number of metal rings as the filtering medium

a metal edge-filter (in which the filtering surface is made up of the edges of a large number of rings spaced accurately a few thousandths of an inch apart) with a fine filter bed, such as powdered carbon or kieselguhr, forming a layer over it and firmly supported by the metal sub-structure. The actual filtering is carried out by the bed; the porosity and chemical or physical nature of this can be varied to eliminate bacteria or remove precipitates, to withstand chemical attack or temperatures from below 0°C. up to red heat.

The "Streamline" filter was developed from a discovery made during the study of streamline flow, when it was found that paper joints separating sheets of glass between which the shape of streamlines was being studied had the effect of permitting flow past their edges and at the same time removing

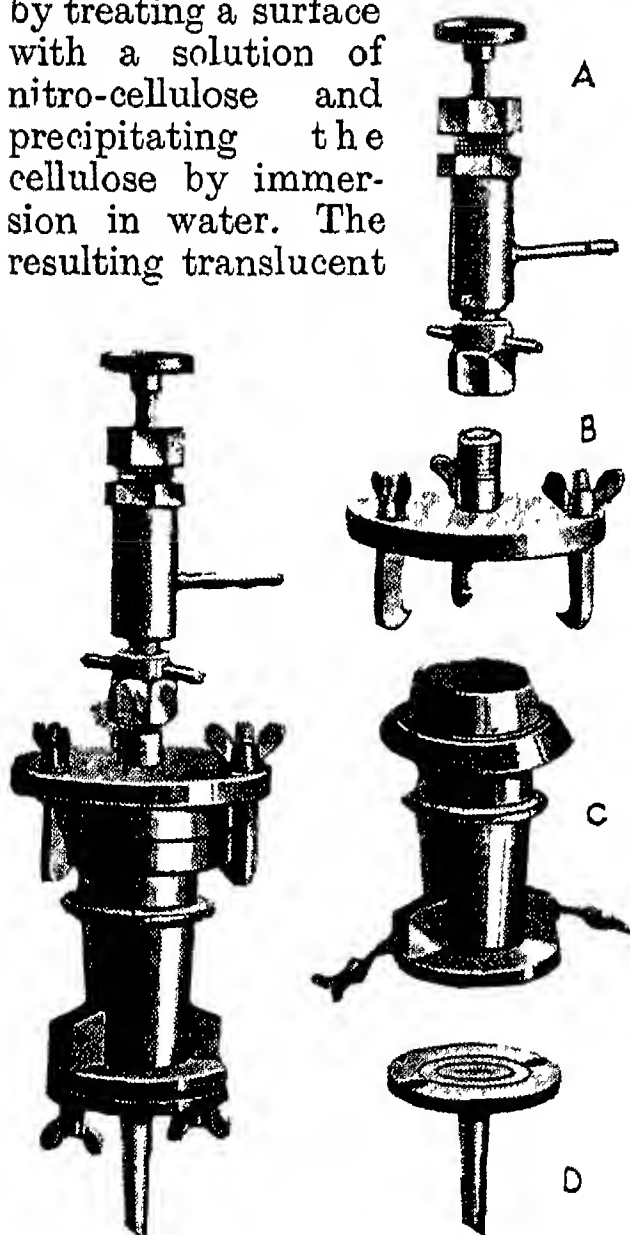
extremely finely divided material. This discovery gave a filter in which many sheets of suitable paper were superimposed with their edges all in line to form a filtering surface. In the filter shown in



Filter. Fig. 2. Paper pack (left) and filter body (right) for edge filter.

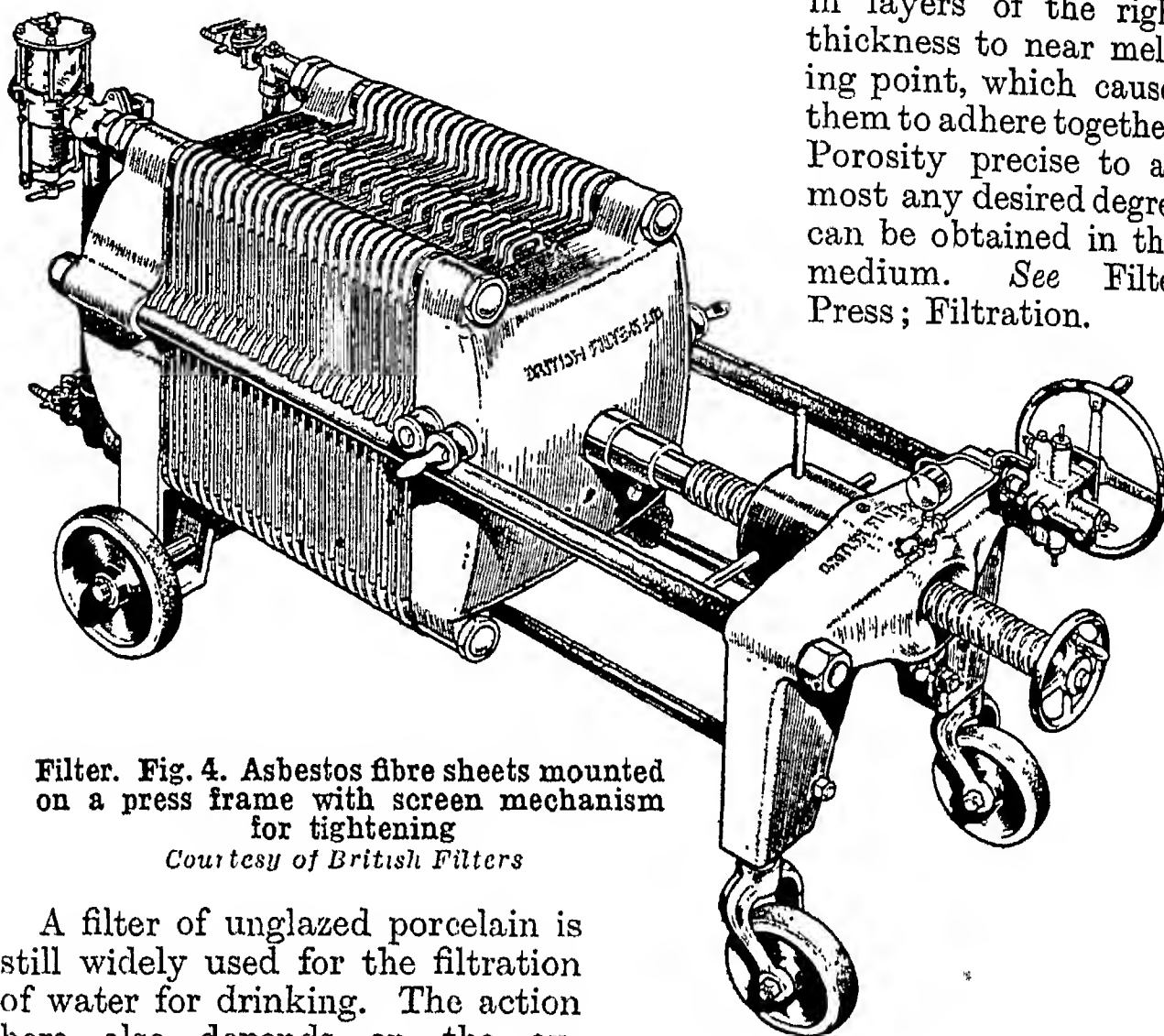
Fig. 2, the paper rings composing it are about two inches in diameter with a half-inch diameter hole, forming a drainage pipe in the middle. The pack is mounted in a filter body, and liquid forced through from the outside to the central hole, by pressure or by suction. The solids collect on the outside. This type of filter is fine enough to remove colloidal particles.

In the "Ultrafilter" (Fig. 3), the filtering medium is a film of excessively fine porosity, often produced by treating a surface with a solution of nitro-cellulose and precipitating the cellulose by immersion in water. The resulting translucent



Filter. Fig. 3. "Ultrafilter" which can be used for pressures up to 12 atmospheres with about one sq. in. of filter surface. Funnel (D) carries the filtering membrane on the perforated plate and is clamped by wing nuts to cone (C) containing liquid. Cover (B) is tightened and pressure applied through regulating valve (A). Left. Filter assembled

film is covered with tiny pores, small enough to prevent the passage of colloidal particles down to one hundred-thousandth of a millimetre. The "Ultrafilter" works by straining and is consequently very easily cleaned by backflushing; but the technique of its use is difficult, as the film is excessively delicate and the filter usually has to be operated under very high pressure. Construction of a large size "Ultrafilter" is scarcely practicable.



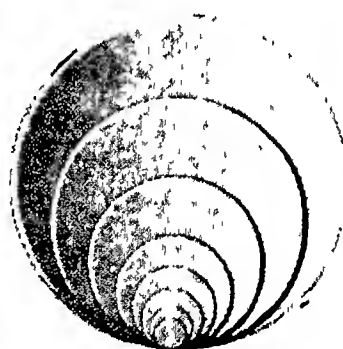
Filter. Fig. 4. Asbestos fibre sheets mounted on a press frame with screen mechanism for tightening
Courtesy of British Filters

A filter of unglazed porcelain is still widely used for the filtration of water for drinking. The action here also depends on the extremely fine pore size of the material. The pores, although larger than those of the "Ultrafilter," will remove bacteria, but not viruses. The filter is usually a hollow cylinder with a spigot outlet projecting through the bottom of a container. It is easy to use, but difficult to clean on the outside and impossible to clean on the inside. A similar filter is made from kieselguhr lightly cemented and pressed into solid form; this removes bacteria and filters quicker than a porcelain filter; it is even more fragile.

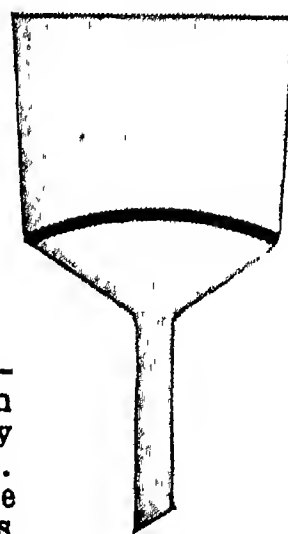
A widely used type of filter is made of sheets of compressed asbestos fibre, sometimes of varying degrees of porosity but with a closeness of structure sufficient to remove bacteria and spores. The

sheets are mounted in a specially constructed press (Fig. 4), built closely on the lines of a filter press. Though the asbestos sheets, which are expensive, can be cleaned to some extent by washing, it is generally found that they have to be discarded rather frequently.

The sintered glass filter (Figs. 5 and 6) is popular for laboratory use. Glass particles are first classified by sieving within suitable dimension limits, and then heated in layers of the right thickness to near melting point, which causes them to adhere together. Porosity precise to almost any desired degree can be obtained in this medium. See Filter Press; Filtration.



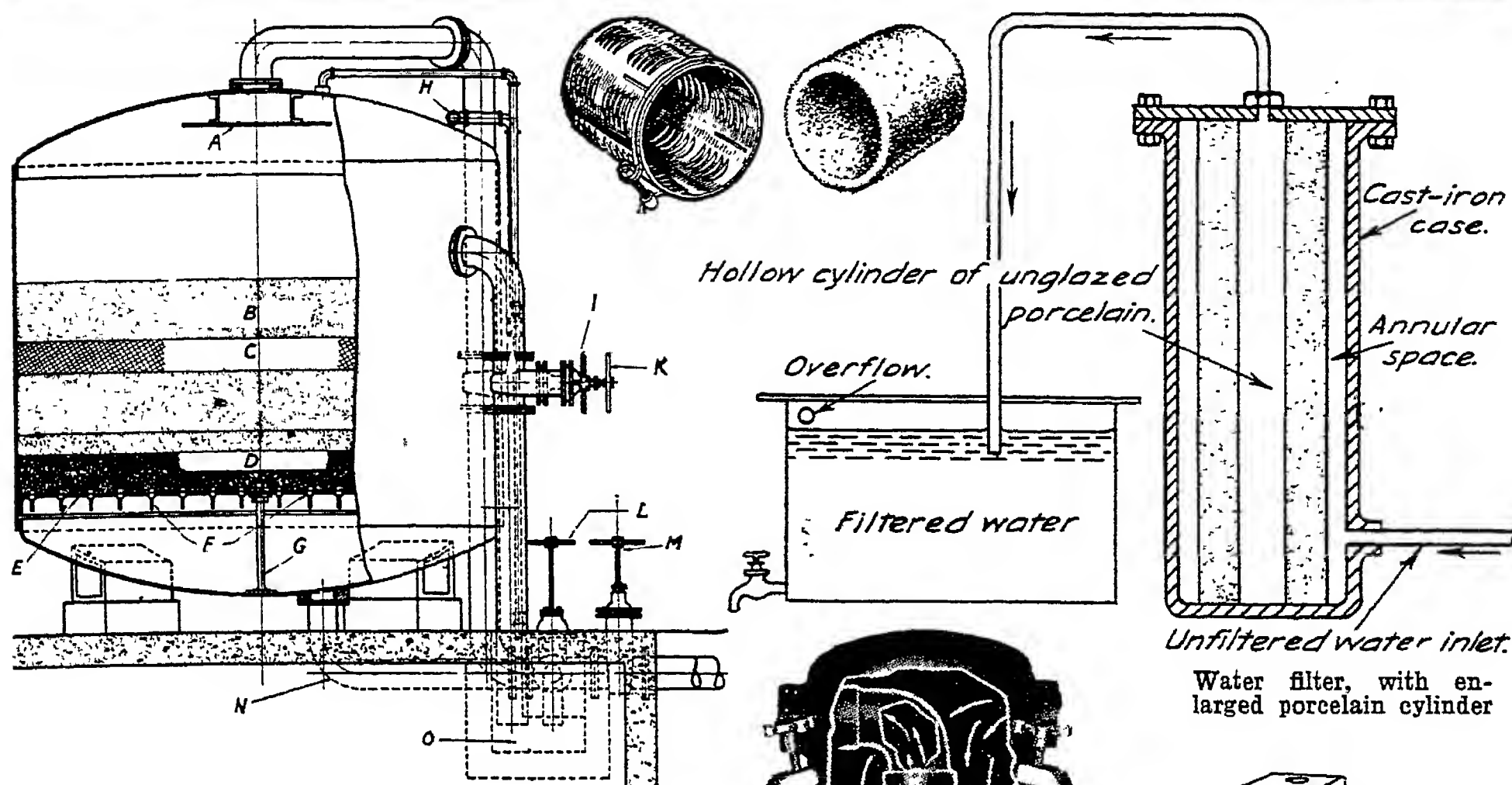
Filter. Fig. 5 (left). Sintered glass discs which can be used in ordinary funnels. Fig. 6 (right). Funnel of Buchner type with the sintered glass septum fused in



Filter Press. Device for separating solids from liquids by filtration under pressure. The earliest filter presses consisted of frames supporting filter cloths placed side by side or piled upon one another and held together in a screw press. This structure is still the basis of a filter press; but pressure is now applied to the liquid to force it through the assembly, and it is this pressure, rather than that holding the plates together, which is in mind when the filter press is referred to.

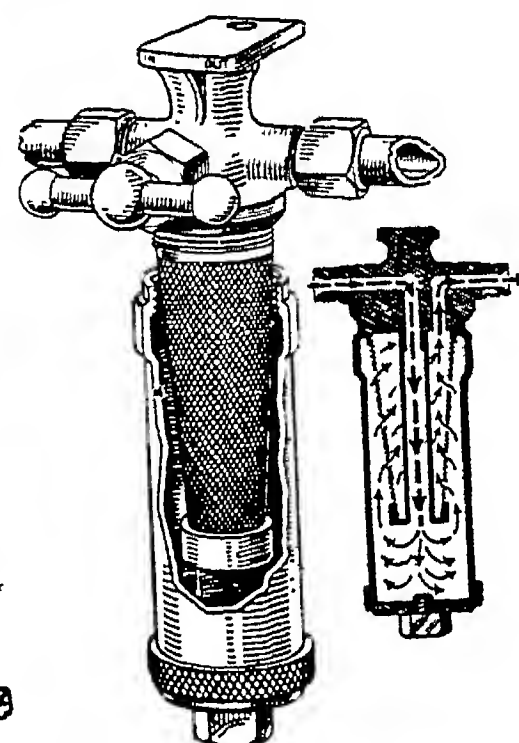
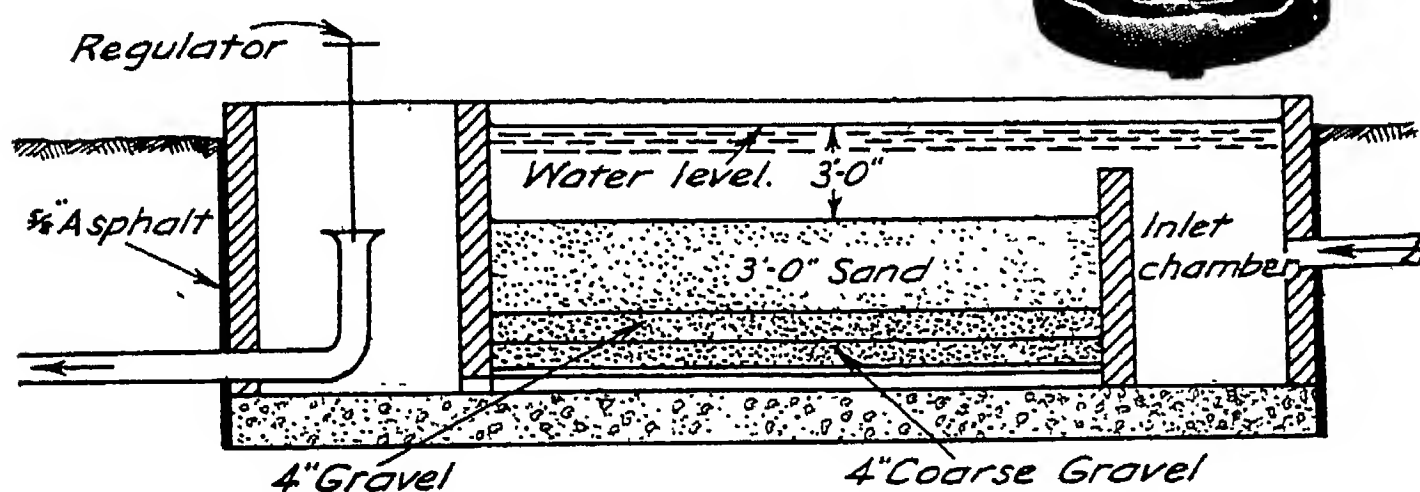
There are two main types of filter press: (1) for removal and collection of precipitates from liquids, the usual filter press; (2) for the expression of liquids from solids, often called an extraction press.

Filter presses proper can be subdivided into (a) the recessed plate type filter and (b) the flush plate



Filter. Types used for air and water. Above: polarite pressure filter; A, spreader plate; B, sand bed; C, layer of polarite; D, graded gravel; E, nozzle plate; F, nozzles; G, stay rod; H, air main; I, unfiltered water inlet valve; K, washwater outlet valve; L, drain valve; M, filtered water outlet valve; N, filtered water outlet pipe; O, washwater drain sump. Top centre, air filter for motor car engine, felt cylinder at right. Below, small sand filter shown in section

Candy Filter Co. Ltd.



Petrol filter for motor car engine. Above left, air filter for vacuum pump to prevent ingress of abrasive material
Dollinger Corporation, N.Y.

and distance frame filter. Both types when in operation consist of a series of chambers having walls covered with filter cloth, provided with drainage channels which lead down to filtrate outlets (see Fig. 1, p. 3338). The filtering frames covered with cloth are mounted vertically so as to face each other and slide on the side members of the press frame and are tightened by the operation of the screw mechanism. The liquid enters the press at the far end and emerges from both frames through the filtrate cocks shown at the sides, the filtered liquid being collected by the trough.

The internal construction of a recessed plate filter is shown in Fig. 2, (p. 3338), of a section through the closing head and the first chamber. This press has centre feed. A, A1, and A2 are filter plates forming chambers

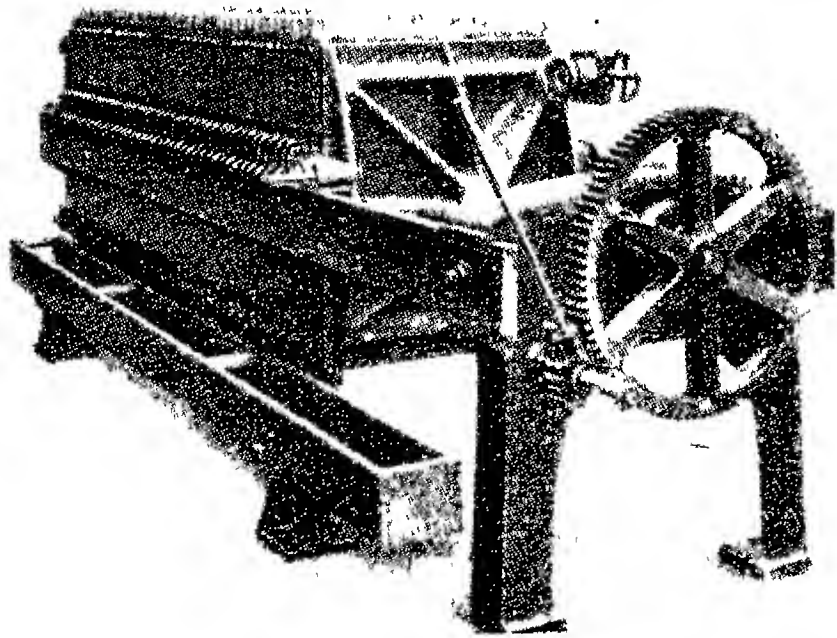
B, B1, and B2, into which the material to be filtered enters by means of inlet D. The outlets for the filtrate connect to the ports marked E. The rims C of the plates are machined so that when the plates are tightened into position, the cloth makes tight joints between the plates. Each chamber is thus completely lined with cloth so that, when the material to be filtered is forced in under pressure, the solid particles are retained by the cloth, and the liquid portion, freed from suspended matter, passes through to the outlet.

A filter with flush plate and distance frames is shown in Fig. 3 (p. 3338): F are the filter plates and D the distance frames which form the chambers. A is the inlet passage for the material, having ports B connecting it to the interior of the chambers. C are

ports connecting to the outlets for the filtrate which may terminate in cocks or run into a common closed delivery passage. The plates have faced joint surfaces flush with the filtering surface, the chambers being formed by hollow frames with plane surfaces corresponding with those of the plates between them. The cloths are hung over the plates so that each chamber has a cloth on both sides.

Filter presses are convenient where moderate proportions of solids, say up to 10 p.c., have to be removed from the liquids. They are used until the space within is filled with solids, which can be washed out, without taking down the filter, by passing water through it.

Filter presses require rather more labour than some other types of filter, but are almost indispensable for many operations,



Filter Press. Fig. 1. Cloth filter frames mounted vertically and compressed by an operating screw; trough for collecting filtered liquid is seen at left

particularly in chemical manufacture, in which steam heated models are sometimes used. They are usually constructed of cast iron, but can be made in almost any metal. Their surfaces are protected from attack by many different coatings. Cloths are also made in many different qualities and grades to suit different needs.

Extraction presses are used chiefly in the separation of oil from nuts and seeds. Before the material is put into the press, it is prepared, usually by grinding and heating. The Anglo-American or plate type of press, which produced flat rectangular residue cakes, was rather laborious in use: it consisted of a large number of frames or trays, piled one on top of another, each of which had to be packed separately with extraction material. Pressure applied to the whole pile expressed most of the oil, but some remained in the margins of the cake, and these had to be trimmed off and re-pressed.

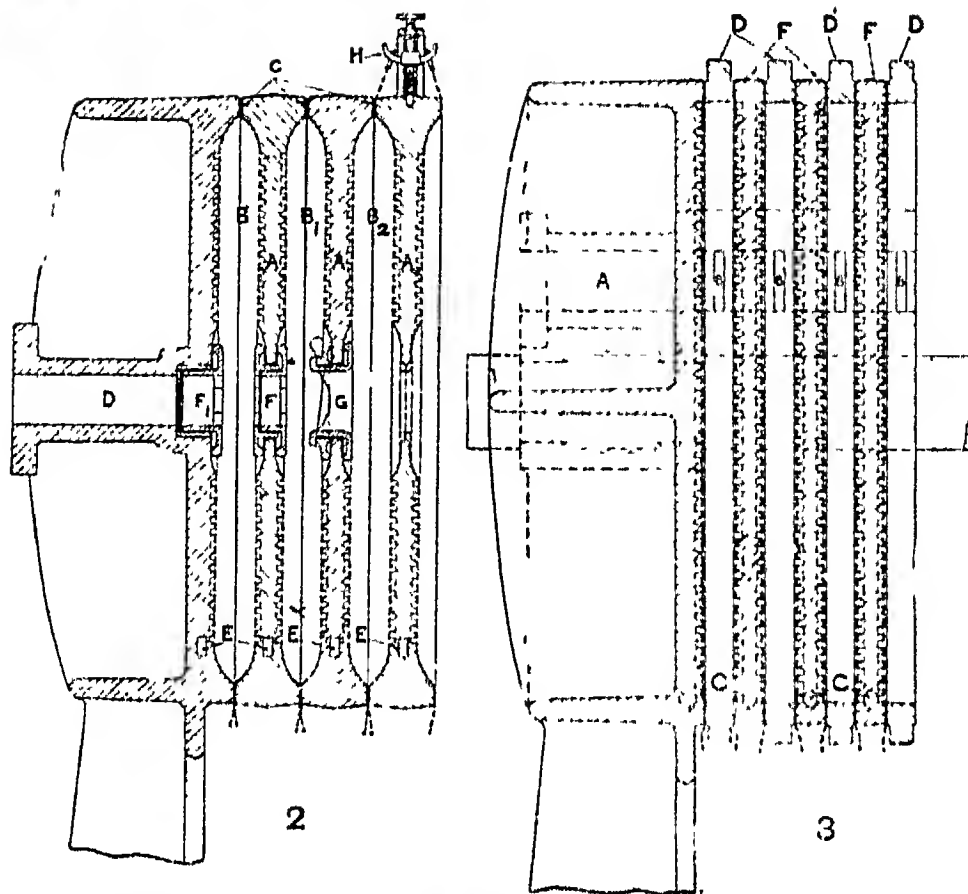
The continuous automatic oil expeller tends to displace the plate press. Prepared meal is placed in the cooker above the expeller (see Fig. 4). Steam valves closely control the temperature and moisture content of the meal, which is fed through an adjustable valve to the expeller-pressing cages. Here the cooked meal is subjected to heavy pressure by means of specially shaped and pitched worms, and is propelled through the cage in a continuous column and finally discharged at the cage end past an adjustable

choking device which determines the final pressure applied. The expressed oil leaves the cage through bars which form the cage lining, set at five-thousandths to fifteen-thousandths of an inch apart, depending on the material. The expelled cake is in

water, without danger of disease, filtration is essential.

Two general types of filter are in use: (1) the slow sand filter (*v.s.*), first used in Great Britain early in the 19th century. It depends substantially on biological activity for its efficiency, and is controlled largely by climatic conditions; (2) the rapid or mechanical sand filter, developed during the 20th century. This has greater flexibility and is more amenable to control.

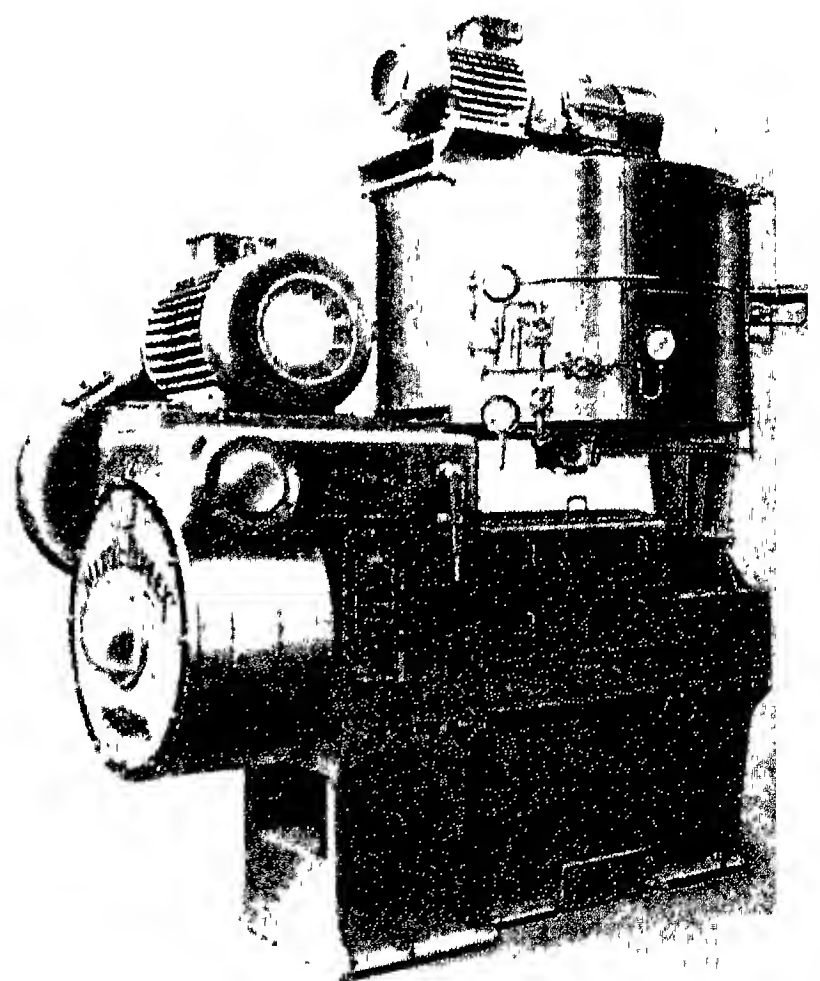
Slow sand filters are now seldom constructed except as additions to existing plant. They consist of rectangular brickwork or concrete basins, on the bottom of which are channels, perforated pipes, or other under-drains supporting gravel on which rests a bed of sand. The under-drain system must be so designed that its frictional resistance when the filter is operating does not exceed 25 p.c. of the frictional loss occurring in the sand when it is clean. During operation the water depth over the sand is generally 4 ft. when the sand is at full depth, which should be 2 to 3 ft. above 1 to 2 ft. of gravel. The sand should be hard, durable grains, free from impurities such as clay, iron, sulphates, phosphates, and organic



Filter Press. Fig. 2. A, filter plates; B, chambers between plates; C, rims of plates; D, unfiltered liquid inlet; E, filtered liquid outlet ports; F, screwed unions, holding cloths at centre; G, instantaneous clip for holding cloth; H, adjustable hook to hold up cloth. Fig. 3: A, inlet passage for unfiltered liquid; B, ports admitting filtered liquid to chambers; C, ports admitting filtrate to outlet passage; D, distance frames; F, filter plates

thin flakes of irregular shape up to $\frac{3}{8}$ in. thick, and is quite hard when cold.

Filtration. Process of removing fine solids from liquids. The two uses of the process of most interest to the general public are in the purification of water supplies and of sewage. Most waters require treatment either for the removal of disease germs and unpleasant taste and odour, or for the elimination of gases, murkiness, and colour. Methods of treatment are storage and simple sedimentation; rapid sedimentation with chemicals as coagulants, followed by filtration. To produce a clear, sparkling



Filter Press. Fig. 4. Continuous extraction press for the expressing of oil from oil seeds. This type of press has the advantage of continuous productivity as against batch pressing

matter, and should be carefully graded. Rate of flow through the bed, which is downwards, is usually between 2 and 6 inches an hour, equivalent to from 1.1 to 3.3 million galls. per acre per day, at which rate it is reasonable to expect that 98 to 99 p.c. of the bacteria have been removed. The greater part of the purification of the water is effected in the top few inches of the bed, which is cleansed by scraping off the top layer and exposing a fresh surface of sand. The sand removed can be washed and replaced. It is not advisable to

reduce the sand bed by more than a foot before replacement. After cleaning, the beds are refilled with filtered water from below until the sand is completely covered, thus preventing the entrapping of air in the sand.

Rapid filters are of two types, the open gravity filter and the closed pressure filter. The essential characteristics are (1) careful pre-treatment of the water; (2) high rate of filtration, the speed varying from 60 to 150 galls. per sq. ft. per hr. according to the character of the water to be filtered (100 galls. per sq. ft. per hr. is equivalent to approximately 105 million galls. per acre per day, and this rate is in fairly general use); (3) washing the filter units by a reverse flow of filtered water upward to remove impurities which have lodged in the sand.

The filters are built in units which are constructed usually of concrete for the open gravity type, and of steel cylinders for the closed pressure type. They contain a bed of sand resting on gravel, with suitable water distributing arrangements at the top and under-drainage system at the bottom. In some filters, compressed air is admitted as part of the back-washing process, and in others the sand bed is agitated mechanically during washing. The sand

used should be free from dirt, hard and resistant, and preferably of quartz or quartzite. It should not contain more than 2 p.c. of lime and magnesia calculated as carbonates. The effective size specified is between 0.44 mm. and 0.6 mm. and the uniformity coefficient not more than 1.7. The depth of the sand bed should be $2\frac{1}{2}$ to 3 ft., of the supporting layer of graded gravel 1 to $1\frac{1}{2}$ ft., and of the water above the sand 3 to 4 ft. The sand removes bacteria, finely divided clay, and colloidal matter even smaller than the sand grains, and this is accounted for by the fact that the minute void spaces act as small sedimentation chambers, permitting the suspended particles to come in contact with the sand surfaces which soon become sticky, particularly if small amounts of flock come into the bed from the coagulation process. There is soon accumulated in the top few inches of the sand various suspended matters which form a dense blanket of mud, flock, and living or dead organisms, which is called *schumtzdecke*, or dirty skin. It is possible, also, that removal of colloidal matter is brought about by sand particles which have an opposite electrical charge to the ions of the colloids, the grains attracting colloidal matter until their charges are neutral-

ised. The accumulated material is removed by washing, and the sand's electrical charge is restored.

Rapid filters are considered the more desirable in ordinary circumstances, although there is a field for the slow filter where the water is very clear and requires preliminary treatment for a limited time only. The over-all bacterial efficiencies of the two types are the same. The slow filter requires less skill in operation; generally costs less to operate; uses less wash-water. The rapid filter will clear more turbid water; is more efficient in colour control; has greater flexibility in operation because it involves chemical pre-treatment; involves less interruption of service during cleaning; is lower in first cost, taking into account the cost of land. (*Consult Examination of Waters and Water Supplies*, E. V. Suckling, 5th ed., 1943.)

SEWAGE. Biological filtration, used at the majority of sewage disposal works in Great Britain, developed from earlier systems in which sewage was allowed to percolate downwards through porous soil, the liquid then being drained away through agricultural drains laid at a distance of 3 or 4 ft. from the surface. The sewage is first passed through screens and detritus channels to remove coarse suspended solids and grit and is



Filtration. Slow sand filter-bed at a Metropolitan Water Board's London works. Workmen are seen shovelling the sand-bed into heaps before the process of washing and relaying of the sand, preparatory to a new fill-up of water

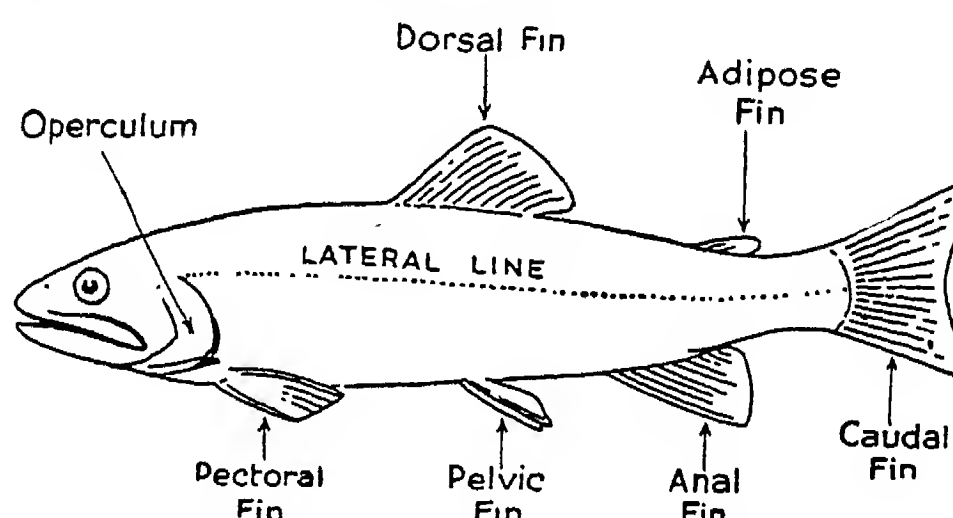
treated in sedimentation tanks in which a large proportion of the fine and colloidal suspended matter is removed. Supernatant liquid from these sedimentation tanks is treated in percolating filters.

A percolating filter is designed to purify the settled sewage rapidly by biological action. It comprises (1) a concrete base sloping to the centre or to the periphery in such a way that the filtered sewage easily runs away to collecting channels; (2) a system of under-drains resting on the base and designed for rapid and easy removal of the filtered liquid; (3) a wall to retain the filtering medium; (4) a bed of filtering medium; (5) a distributor through which the settled sewage is supplied evenly over the surface of the filter.

The Filtering Medium

The filtering medium should be well graded; the size of the pieces differs for different purposes, but is commonly from 1 in. to 2 ins. The chief requirements of the filtering medium are that it should be durable and chemically inert. Material used on a large scale includes water-worn gravel, broken stone, metallurgical coke, slag, and clinker. In Great Britain the depth of filtering medium is commonly 6 ft. It is very important that there should be a free current of air through the bed of medium, and for this reason ventilating holes are provided at the bottom of the retaining wall to induce an upward draught of air through the filter. The even distribution of settled sewage over the surface of the filtering medium is usually achieved by passing it through fixed sprays, or through rotary distributors (for circular filters), or through distributors moving backwards and forwards (for rectangular filters).

It is usual to start new filters by applying settled sewage at a low rate, the dose being gradually increased as the pieces of medium become coated with the biological film of material from the sewage containing bacteria and, especially at the surface, fungi, and providing food for numerous other organisms which live in the spaces between the pieces of medium. The most important types are springtails, worms, and the larvae of certain flies. These "scouring" organisms play an important part in restricting the excessive growth of biological film which might otherwise choke the filter. Adult flies, however, emerging from percolating filters sometimes cause a nuisance, and it may be necessary



Fin. Diagram of the outline of a fish showing the positions of its various fins

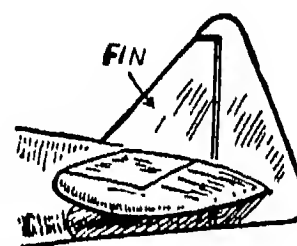
to treat a filter with insecticide to reduce the number of fly larvae.

Settled sewage contains colloidal organic matter which it is impossible to remove by further sedimentation. Effluent from a percolating filter contains coarse suspended matter ("humus") consisting partly of pieces of biological film broken away by the action of the scouring organisms. This humus can fairly readily be removed by sedimentation in humus tanks. Settled sewage may have a biochemical oxygen demand of 25 parts per 100,000; it usually contains no nitrite or nitrate, but may contain perhaps 5 parts per 100,000 of nitrogen in the form of ammonia. A settled filter effluent should have a biochemical oxygen demand not exceeding 2 parts per 100,000, and most of the ammonia should have been oxidised by biological action to nitrate.

The permissible rate of filtration of settled sewage to yield an effluent of good quality depends on the strength of the sewage, but for a liquid of average strength is usually of the order of 60 to 90 gallons per cubic yard of filtering medium per day. If the permissible rate is exceeded the growth of biological film in the filter may increase to such an extent as to cause first "ponding" on the surface of the medium, and finally complete blockage of the filter. At the same time the quality of the final effluent would usually deteriorate. Advances in the technique of biological filtration, however, have made it possible under favourable conditions to increase considerably the rate of treatment of the settled sewage. Current systems of filtration include (a) treatment in covered filters with forced circulation of air from the top downwards, (b) filtration of settled sewage mixed with settled effluent pumped back from the humus tanks and mixed with the settled sewage before application to the filter, and (c) alternating double filtration.

Fin (Lat. *penna*, wing, fin). Expansion of the skin or body wall in aquatic animals, by means of which they swim. In the fishes fins are of two kinds, paired and unpaired. The former correspond to the limbs in the higher animals: the latter consist usually of centrally placed dorsal, anal, and caudal fins.

Fin. In aeronautics, any fixed subsidiary vertical plane or surface usually at the rear part of the fuselage of an aircraft. The fin is generally mounted in front of the rudder, and its purpose is to increase the stability of the machine. A cooling rib of metal formed on the cylinder of an engine is also termed a fin. Its purpose is to facilitate the radiation of heat from the engine and prevent overheating. Fins are fitted to paravanes (*q.v.*) to ensure their remaining at a constant depth when submerged, and largestabilising fins are fitted to the rear of some racing cars to keep them on a level course when travelling at high speed. See *Acroplane*.



Fin of an aeroplane

Finale (Ital., end). Closing movement of a composition of extended character, such as a sonata, symphony, or concerto; or the last portion of one of the acts of an opera, in which as a rule a large number of the performers assemble on the stage. The operatic finale often consists of several distinct movements, but all leading up to the final ensemble. As the coda is the concluding section of a single movement, so the finale winds up a complete work consisting of several movements.

Finance Act. The annual act of the British parliament that legalises proposals contained in the budget (*q.v.*).

Financial Secretary. Official of the British Treasury. The appointment is a political one, its holder being a junior member of the government whose duty it is to advise the chancellor of the Exchequer on financial policy, in particular in relation to matters affecting the civil service. The parliamentary secretary of the Admiralty is also its financial

secretary; the parliamentary under-secretary of state for War is also financial secretary of the War office.

Financial Times, THE. London daily newspaper, founded by Horatio Bottomley in 1888. It has the largest circulation of any financial paper in the British Commonwealth. It reports all financial matters, company meetings, and stock exchange dealings, and gives world-wide industrial news. From time to time industrial surveys are published as part of a normal issue. In 1924 the Financial Times absorbed the *Financier* and *Bullionist*, an amalgamation of two journals begun respectively in 1870 and 1866. In 1945 it was merged with the *Financial News* (founded 1884). Its head office is at 72, Coleman Street, London, E.C.2.

Finch. Name applied to a large family of small birds, Fringillidae, distributed over most of the temperate zone, except Australasia. They are characterised by hard conical beaks, and have nine primary wing feathers and twelve feathers in the tail. The nostrils are close together, and there are a few short bristles around the mouth. In most species the sexes are differently coloured or marked. Finches are in the main seed-eaters; they are commonly found in small companies, and they frequent both woods and open country. Among the commoner finches in Great Britain are hawfinch, greenfinch, chaffinch, brambling, goldfinch, siskin, linnet. See Brambling illus.

Finch, JOHN FINCH, BARON (1584–1660). English politician, born Sept. 17, 1584. Elected Speaker of the house of commons in 1628, he figured in a scene when he was held down in his chair during Sir John Eliot's remonstrance against tonnage and poundage. Chief justice of the common pleas in 1634, he presided at Hampden's trial for refusal to pay ship money. A zealous servant of the crown, Finch was made lord keeper and a peer in 1640, but was later impeached and spent years in exile during the Civil War and Commonwealth. He died Nov. 27, 1660, in England. Consult *Life and Times*, W. H. Terry, 1936.

Finchley. Municipal bor. and residential area of Middlesex, England. E. of Hendon, N. of Golders Green, Hampstead, and Highgate, and S. of Whetstone and Barnet, it is approached from St. John's Wood by the Finchley Road, from Highgate by the Great North

Road; these roads converge at Tally Ho corner (N. Finchley). The bor. is served by London Transport. It contains Church End, and part of Hampstead garden suburb. Near the Perpendicular parish church of S. Mary, restored in 1872, is Christ College, founded 1857. About 90 acres of what was Finchley Common, once a resort of highwaymen and the scene of several military encampments, are occupied by the Islington and St. Pancras cemeteries; St. Marylebone cemetery is between East Finchley and Church End. General Monk mustered his forces here in 1660, and the Guards were assembled here in 1745, an event commemorated in Hogarth's picture, *The March to Finchley*. Finchley with the urban district of Friern Barnet forms a borough constituency. Pop. (1951) 69,990.

Finck, HERMAN (1872–1939). British conductor and composer. Born in London, Nov. 4, 1872, he studied at the Guildhall School of Music, was musical director of the Palace Theatre, London, 1900–21, and at Drury Lane, 1922–31. He composed music for many musical comedies and revues, as well as hundreds of songs and light pieces, of which the most popular was *In the Shadows*. He also specialised in attractive arrangements of popular airs, his *Melodious Memories* (over 70 tunes in 15 minutes) being a masterpiece of its kind and giving its name to his autobiography, published 1936. He died April 21, 1939.

Findhorn. River of the counties of Elgin, Nairn, and Inverness, Scotland. It issues from the Monadhliath Mts., and flows N.E. for 62 m. to Moray Firth, which it enters 2 m. N. of Forres through Findhorn Bay. Findhorn, a fishing village and watering-place, is on the E. shore of the bay.

Findlay. City of Ohio, U.S.A., the co. seat of Hancock co. On the Blanchard river, 44 m. by rly. S.S.W. of Toledo, it is served by several rlys. and an airport. Findlay is situated in an agricultural, oil, and natural gas region. Agricultural products include livestock, poultry, grain, and sugar beet; manufactured articles, lorry bodies, motor car parts, tires, cigars, gloves, brick, stone, and lime. Laid out in 1821, it was incorporated in 1838, and chartered as a city in 1890. Pop. (1950) 23,845.

Findlay, SIR JOHN GEORGE (1862–1929). New Zealand statesman. He was born at Dunedin.

Oct. 21, 1862, and went to Otago university. After being prominent as a lawyer he became attorney-general, minister of justice, and colonial secretary. In 1911, with Sir J. Ward, he represented New Zealand at the Imperial Conference. Ever a strong advocate of Imperial federation, he made a special study of the problems of Imperial policy in the Pacific. He died Dec. 7, 1929.

Findon. Village of Kincardineshire, Scotland. It is on the coast, 6 m. S. of Aberdeen. Fishing is carried on, and the village gives its name to the Findon or Finnon haddocks, which were first cured here.

Fine (Lat. *finis*, the end). Term common in English law. Originally it was a sum of money imposed upon someone by way of compounding, i.e. paying to make an end of the matter instead of going to prison or paying in several instalments. By feudal law a leaseholder often pays a fine for the renewal of his lease. The word is most often applied to a sum of money imposed as a penalty for a criminal offence or breach of some law or regulation. The maximum is usually fixed by a statute, the exact amount being decided by the court.

Fine Arts. Term comprehensively embracing all the five greater arts which minister to the love of the beautiful, the intellectual, and the tasteful, viz.: music, poetry, painting, sculpture, architecture.

In England, the Royal Fine Art Commission, 5, Old Palace Yard, London, S.W.1, was appointed in 1924, to advise on request departments of state and other public or quasi-public bodies on "questions of amenity or public importance." Its scope was extended in 1933 and in 1946 so that it could initiate inquiries and call evidence on such questions. The Royal Fine Art Commission for Scotland, Royal Scottish Museum, Edinburgh, appointed 1927, extended in scope 1953, has a similar function in Scotland.

Fine Gael. (Irish, stock of the Gael). Party formed from the remnants of the Cosgrave (*q.v.*) pro-treaty party in Dáil Eiréann which was in power in the Irish Free State during 1922–32. In 1948 Fine Gael secured 31 seats and combined with other parties to form a coalition govt. led by J. A. Costello, a member of Fine Gael.

Fines and Recoveries. Legal fiction introduced in England to override an act of parliament

which was against the public interest. By the statute *De Donis Conditionalibus* (on conditional gifts) in 1285, it was enacted, in effect, that land which was entailed could never be disentailed; so that if an estate were given or left to A in tail, it must always keep in A's family and could never be sold. By this, among other things, the creditors of A, or his heir in tail, could never touch the land for their debts. The judges were strongly opposed to the policy of the barons who had passed this Act, because they thought it against the public interest that land should be made inalienable.

Therefore from about 1400 they connived at fines and recoveries, which were fictitious actions worked thus. A is the holder in tail of Whiteacre. He wishes to disentail, so that he can sell or mortgage, or divide his land amongst his family. An action is brought by X, claiming the land from A, X alleging that the land was his in fee simple (*q.v.*). A, on getting into court, says that the land was granted to him by Q, who was in fact, the usher of the court; Q was then called upon to come into court and defend his title. Of course Q put in no appearance. Judgement was thus given in favour of X; and X, having recovered the land as a fee simple, promptly reconveyed it to A as a fee simple, free from the entail. By an Act of 1833 fines and recoveries were abolished. See *Fiction, Legal*.

Fingal's Cave. Cavern in the island of Staffa, Scotland, the most notable of its kind. Hollowed out of the basalt, the grotto is 228 ft. long, 48 ft. wide, and 60 ft. high. It is remarkable for its regular basaltic columns, for its wonderful and varying colours revealed as the light plays upon it, and for its stalactites. On the S. of the island, it was discovered by Sir Joseph Banks in 1772. Sea birds live in the



Fingal's Cave, Staffa. The pillared entrance to the grotto

cave, which is also noted for the sound made at times by the wind rushing out of it. In Gaelic speech it is called the cave of music. Mendelssohn's overture, op. 26, alternatively called *The Hebrides* or *Fingal's Cave*—composed 1829—is regarded as one of the finest portrayals of the sea in music.

Finger. Terminal member of the hand. The bones or phalanges of the fingers are three in number



Finger. Bones of human fingers

in each finger, except the thumb, which has only two. The fingers articulate with the metacarpal bones of the palm. Along the backs of the fingers pass the tendons of the extensor muscles, which straighten the fingers, and along the fronts the tendons of the flexor muscles, which close the hand. The blood supply of each finger is derived from two digital arteries which run along each side of the finger and unite at its extremity. The nerves which supply the skin are derived from the ulnar, radial, and median nerves.

The digits are named pollex, or thumb, index, medius, annularis, and minimus.

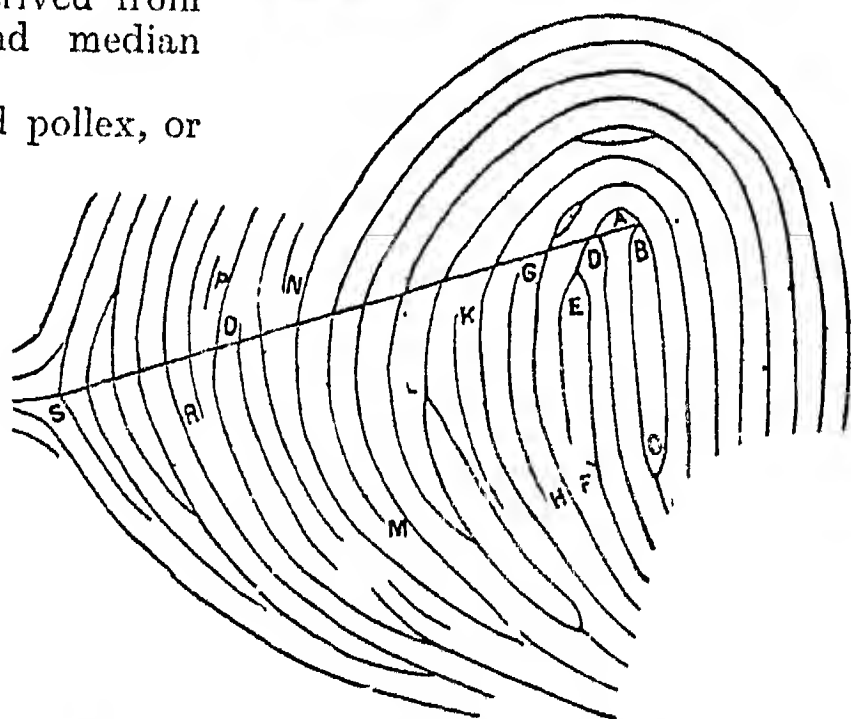
Supernumerary fingers are not uncommon. In a case on record there were twelve fingers on one hand and thirteen on the other, and twelve toes on each foot. Absence of one or more fingers, or part of a finger, may also be a congenital deformity, *i.e.* present at birth. In webbing of the fingers, or syndactylism, a thin web, usually consisting chiefly of skin, unites one or more fingers. Sometimes the union is thick and fleshy. See *Anatomy*.

Finger and Toe. Disease causing malformation of the roots of turnips and other cruciferous crops also known as club-root (*q.v.*).

Fingerboard. Portion of a stringed instrument against which the fingers press the strings in order to regulate the vibrating lengths of the strings, and so control the pitch of the sounds. Bowed

instruments of the violin family have smooth fingerboards on which the player must judge and remember the correct stopping-places; the plucked instruments such as the guitar, mandoline, and banjo usually have frets or cross ridges to assist the player.

Finger Print. Impression of the human finger. It is used to classify human beings; but chiefly for the identification of persons who have passed through the hands of the police. The individuality of finger prints and their value in proving identity were known to the Chinese about 200 B.C., and an impression of the thumb was used in lieu of signature; but it was not till the 19th century that the classification of the ridges on the finger tips was attempted.



Finger Print. Two diagrams illustrating (upper) the actual thumb print in blood left by a murderer, and (lower) the lines of the ridges of this thumb print drawn to facilitate examination. The letters from A to S indicate the various characteristics which distinguish the print, *e.g.* L is the bifurcated ridge, S B is the line joining the two terminal points of the print, to enable the number of ridges to be counted and compared with a known thumb print of the murderer, who was caught and sentenced on the evidence furnished by these two diagrams

In 1823, Purkenje, professor of physiology at Breslau, suggested a system of classification, and in 1858 Sir William Herschel laid the foundations of the present system in Bengal. In 1890 Sir Francis Galton pointed out that ridges on the fingers of a new-born infant were absolutely identical to the day of death.

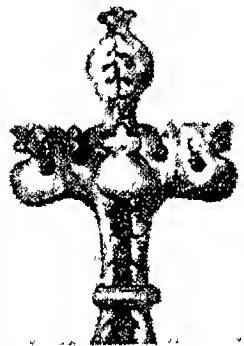
The full value of Purkenje's, Herschel's, and Galton's work was recognized when Sir Edward Henry devised a numerical formula for classifying the impressions. The Henry system has been widely adopted by the police organizations of the world. Under the American Seaman's Law of 1915 the finger prints of every sailor in the American merchant marine were taken for classification of able seamen, etc., and the prevention of fraud; while in the war department finger print records are kept of every soldier. It has been shown that the chance of identity of two finger prints is less than one in sixty-four thousand millions, and the prints of one finger, therefore, are enough to decide the question of identity. If, as is customary, the prints of three or more fingers are taken possibility of error is eliminated.

All finger print impressions are divided into two groups of four types and eight distinct patterns, such as loops, arches, etc. The ten fingers in the Henry system are divided into five pairs, and by a special way of numbering these pairs the classification of a particular finger print is made simple. See Criminology.

Fingo OR AMAFENGU (Zulu, wanderers). Collective name for sundry Bantu-speaking peoples of S.E. Africa whose tribal unity was destroyed by the Zulus under Chaka. In 1835 the government of Cape Colony gave them asylum near the Great Fish river; this Fingoland reserve became, in 1877, one of the Transkei districts.

Most of the inhabitants of the Fingoland reserve have been Europeanised and Christianised, and furnish labour contingents for the harbours and mines.

Finial (Lat. *finis*, end). In architecture, a foliated ornament capping a pinnacle, gable, or stair-post. Occasionally the finials of stair-posts themselves acted as supports for statuary, like those at Cromwell House, Highgate, where they are surmounted by Roundhead figures.



Finial. Example from Canterbury Cathedral

Finiguerra, MASO (c. 1426-64). Italian goldsmith and engraver, born probably at Florence. Details of his life are uncertain. He was trained as a goldsmith in the workshop of the Pollaiuoli. He is stated by Vasari to have invented engraving on metal, but he was only one

of the pioneers in this craft, which he practised together with niello work, of which he was a master. Intarsias by him are to be seen in the sacristy and the cathedral museum, Florence; his prints and drawings are in the Uffizi gallery and the British Museum. There has been much controversy as to his alleged invention of engraving.

Fining (Lat *finis*, end). Process by which liquids are freed of solid matter and impurities, and thus clarified. Though somewhat akin to filtering, it is used in a special sense in the brewing and distilling industries, various substances such as isinglass, sulphate of lime, etc., being employed to collect and carry off the matter in solution, leaving the liquid bright and clear. In fining syrups white of egg may be used, the albumen being dissolved by heat. Wines are similarly fined without the application of heat, the alcohol acting as the solvent. (See Brewing; Distilling.) Fining is also a process in glass-making, and was used in the production of malleable iron before puddling was introduced.

Finistère. Dept. of France. In the extreme N.W. of the country and part of Brittany, it is bordered by the sea on three sides. The Aulne is the most important river. The

coast is rocky and broken, but contains some good harbours. Off it are Ushant and other islands. The dept. is hilly, though not mountainous, and much of the land is covered by forest and heath, useless for growing crops. Elsewhere, however, especially in the south, there is fertile land which produces asparagus, onions, and other vegetables, as well as apples and fruit. Oats and wheat are grown; cattle and horses are reared, while the peasants also keep bees and make butter. Many of the inhabitants are employed in the fisheries. The dept. has five arrondissements. Quimper, liberated by the F.F.I. Aug. 9, 1944, is the capital town, but Brest, centre of a fierce battle, Aug.-Sept., is the most important. Morlaix is also a flourishing port. With the surrender of the Germans in Brest, Sept. 19, 1944, the whole department was liberated. Area 2,729 sq. m. Pop. (1954) 727,847.

Finisterre. Cape on the N.W. extremity of Spain, in the prov. of Corunna. Off the cape two naval actions were fought in 1747 between the British and French, resulting in the defeat of the latter. Admiral Anson commanded the British forces on May 3, and Admiral Hawke on Oct. 14.

FINLAND: LAND OF FOREST AND LAKE

The history and social organization of the Finns, a small, progressive, energetic, and independent-minded people, and a description of the geography of their lake-studded country are given here, together with a brief account of the two wars they fought with Russia between 1939 and 1944

Finland, a republic of N. Europe, lies between Russia on the E., Sweden and the Gulf of Bothnia on the W., Norway on the N., and the Gulf of Finland on the S. Its greatest length is 717 miles, its average breadth about 185. Its area is 130,122 sq. m., including 12,206 sq. m. of inland water. Helsinki is the capital.

Finland's coast-line, which is entirely on the Baltic, is 1,000 m. long, low-lying, highly indented and fringed with islands of which the Aaland Is. (*q.v.*) in the S.W. are the most important. The country consists of a great plateau, at an elevation of 400 to 600 ft., with lowlands round the coast. The surface of the land consists of hard and crystalline rock, granite, etc., for the most part covered with a thin layer of infertile sands and clay. Drainage is bad and the soil is water-logged during most of the year. The southern half of the plateau has about 25 p.c. of its area occupied by thou-

sands of shallow lakes, many of them linked by short natural and artificial channels. In the N. the plateau is more elevated and rugged, rising in many places to heights of over 2,000 ft., but there are no well-defined mountain ranges. The northern part of the country is Lapland and is inhabited by the nomad race of Lapps.

Marsh and bog have occupied about 30 p.c. of the country, but the bog area is being diminished by the united efforts of nature and man. About 12 p.c. is covered by lakes, of which there are more than 60,000. In the S., 120 large lakes and several thousand small ones, all connected and having a natural outlet into Lake Ladoga, spread over an area 502 sq. m. Lake Ladoga, once partly in Finland, but now wholly within



Finland arms

Russia, is adjacent to the Imatra falls (or rather rapids) which for scenery are the finest of their kind in Europe and in volume of water the greatest. There are numerous short rivers broken by rapids and navigable only in stretches, but useful for floating timber. Many of them are well supplied with fish, but are more important as a source of water-power—often severely curtailed by frost in winter and drought in summer.

Forests and Animals

Finland is relatively the most wooded country in Europe, more than half the land surface being under forest. Two-fifths of these woods are owned by the state, the rest privately. A law of 1917 prohibits the reckless felling of timber by private individuals. Scots pine and Norway spruce are the most widespread of the trees and the most profitable; after them come birch, alder, ash, and oak. Among wild animals are bear, fox, lynx, ermine, otter, elk, and hare. The wild reindeer and beaver, formerly abundant, are now extinct. There are over 200 species of birds, not counting the domestic sorts. Seals

are plentiful along the coast and in Lakes Saima and Ladoga. In the rivers, lakes, and seas of Finland there are some 70 species of fish, the most abundant being a kind of herring off the S. and S.W. coasts. It forms an important element in the food of all classes; large quantities, both smoked and salted, are stored for winter. Most of the rivers yield salmon, trout, perch, or pike.

The climate, owing to the prevalence of moist W. and S.W. winds, is less severe than it is farther east in corresponding latitudes. In Jan. the average monthly temperature varies from 90° F. about Lake Enare to 30° along the S. coast; while in July the difference between the monthly averages is only 8°, being 53° in the N. and 61° in the S.E. Everywhere, and especially in the interior, the winter lasts a long time. The summer is short, occasionally very hot in June and July, when the mosquitoes can be a plague. But the long summer days, with the sun only for an hour or two under the horizon, have a peculiar charm. Owing to short

The dominion of the Swedes was very unfavourable to anything like a Finnish literature, the writers of Finland preferring to write in Swedish and so secure a wider audience. It was not until 1835 that the Kalevala appeared, an epic poem formed by E. Lönnrot (1802–1884) out of a collection of popular songs taken down from the lips of the peasantry as they from time immemorial had heard them from their *runolainen* or singers. An idea of the form and metre of the Kalevala can be obtained from Longfellow's *Hiawatha*, which is an imitation of it. The Kalevala has been translated into many languages and has been favourably compared with the *Iliad*.

Later Finnish Writers

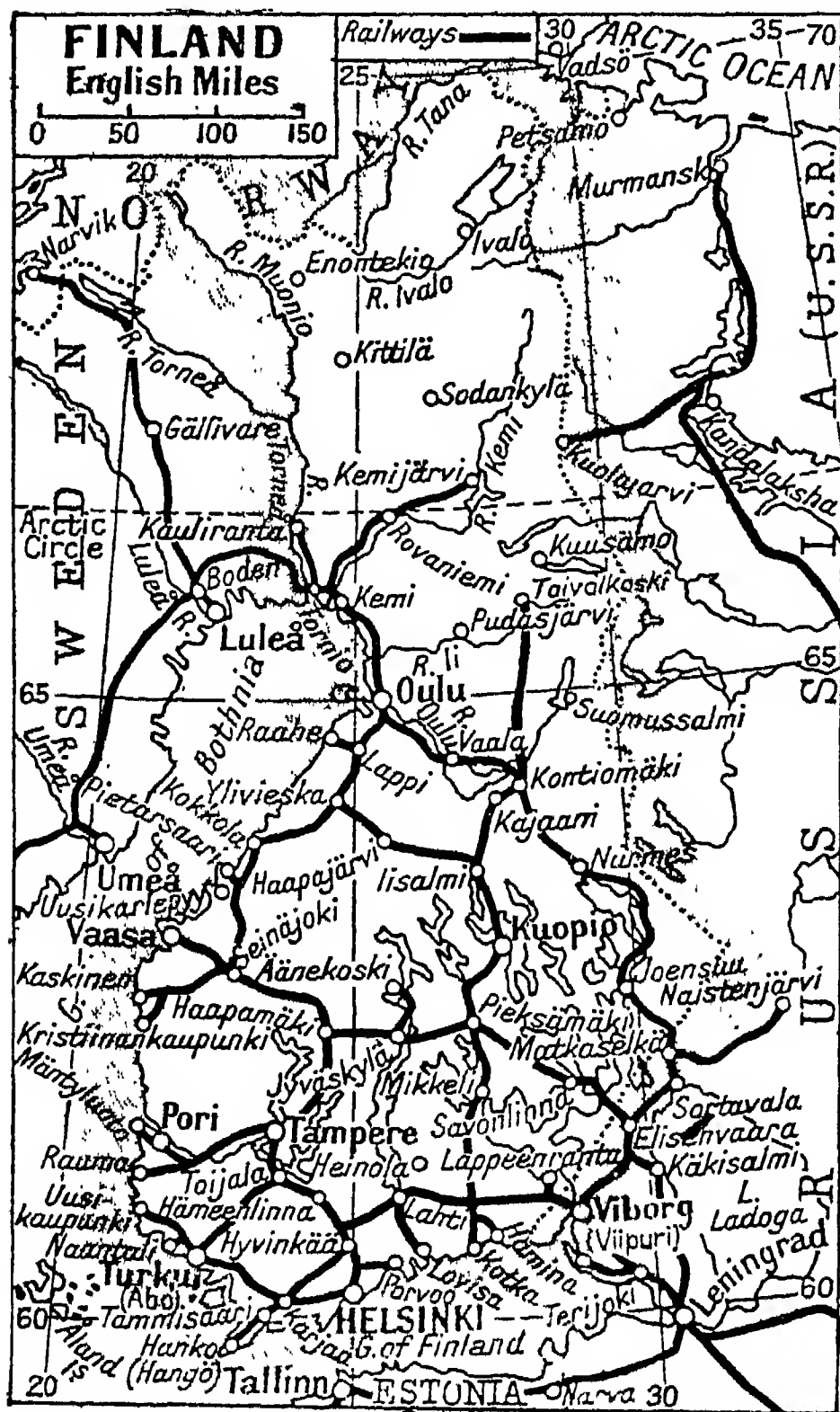
By far the most brilliant of the Finns who wrote in Swedish was J. L. Runeberg (*q.v.*), 1804–77. During the last years of the 19th century there was an ever-increasing literary activity in Finnish, the publication of books in Swedish becoming relatively less. Finland is wonderfully rich in periodicals of all kinds, the publications of the Finnish societies of literature and the sciences and other learned bodies being especially valuable. In imaginative literature there have been several important writers in Finnish, such as Alexis Stenwall ("Kiwi"), 1834–72, the son of a village tailor, who was the best poet of his time. The *Seven Brothers*, an historical romance, is a particular favourite, and he wrote various popular dramas. Finland's earliest novelist was Pietari Paivarinta (1827–1913), the son of a labourer. He wrote the grimly realistic story, *His Life*. The most gifted of writers in Finnish certainly Juhani Aho (b. 1861), the son of a country clergyman. His earliest writings were realistic studies of current life. He went to reside in France, where he made a close study of the methods of French novelists of the newer school. His short stories are delicate works of art, revealing to an interesting degree the temper and ambitions of the contemporary Finnish population.

The only figure of world-wide fame in the arts produced by Finland is Sibelius (*q.v.*)

HISTORY. The Finns reached Finland from their Asiatic home in the 7th and 8th centuries; they found people already living there of whom the present-day Lapps are probably the descendants. In the 12th century

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Finland. Map of this North European republic, once part of the Russian Empire

Sweden sought to introduce Christianity into Finland, but an obstinate struggle with paganism followed, lasting nearly 150 years. One of the leaders of the first Swedish christianising expedition, Henrik, bishop of Uppsala, an Englishman by birth, later, as Henrik the martyr, became Finland's patron saint. Gradually Swedish influence spread round the coasts and for 600 years Finland formed part of the kingdom of Sweden, enjoying, however, a large measure of self-government. From the beginning of the 17th century the Finns had their own diet, the electoral basis of which remained virtually unchanged until 1906; the system then adopted has survived with a few modifications to the present day. The legal system of the Finnish republic is still based on the *Codex Gustavianus*, maintained over several centuries under Swedish kings, Russian tsars, during the civil war, and since the establishment of an independent Finland.

Finland a Theatre of War

Early in the 18th century, Finland became the theatre of bloody struggles between Russians and Swedes. By the treaty of Nystad (1721) Russia secured the province of Viborg (Viipuri). Sweden unsuccessfully tried to recover the lost province in 1741, but the Russian sphere was extended. Finally, in 1809, Sweden withdrew from Finland, the whole of which, with the Aaland Is. passed as a grand duchy to Russia the grand duke being Tsar Alexander I. For many years the relations between Russia and Finland were cordial, and Finland prospered, her autonomy being all but complete save in foreign affairs. Gradually however, a Finnish national party arose, whose first object was to give Finnish the same standing as Swedish, the then official language of the country. This they succeeded in doing in 1863. In 1899 the Finnish constitution was suspended and Russian military government was established. The assassination of the Russian governor, the dictator, Gen. Bobrikov, in 1904, and a general strike led to a temporary respite and in 1906 the constitution was restored. But in 1908 curtailment of Finnish rights began again; but many Finns managed to get through school without learning any Russian, although the teaching of it was compulsory; and in 1914, out of 391 newspapers and periodicals published in Finland.

274 were in Finnish, 103 in Swedish, 7 in Swedish and Finnish, 3 in Russian, 2 in German, 1 in English, and 1 in French.

When, at the outbreak of the First Great War, Russia's coercive measures increased, the Finns, distrustful of Russia's allies, sympathised with the Germans. The Russian revolution of 1917 brought freedom to Finland, which declared itself in Dec. an indepen-



Finland. A typical Finnish peasant family

dent and sovereign state, and was recognized as such.

In 1920 Finland was admitted to the League of Nations and in the following year she was confirmed in possession of the Aaland Is.

RUSO-FINNISH WARS. In Oct., 1939, the Finnish and Russian governments began unsuccessful negotiations over the Soviet demand for frontier readjustment and the right to establish air and naval bases on Finnish territory. Next month Russia denounced the Soviet-Finnish pact of non-aggression of 1932, announced the rupture of diplomatic relations, and stated that her only aim was to safeguard the security of the Soviet Union, and in particular of Leningrad (then only 25 m. inside the Russian frontier). Two days later the Russians attacked. A three months' war followed, chiefly remarkable for the use by the Russians for the first time in war

of parachute troops, and for the unexpectedly good defence put up by the Finns. But Finland was overpowered when the Russians, in Feb., 1940, broke the Mannerheim line, and by a treaty of peace concluded in Moscow and ratified by Finland in March operations ceased immediately. The terms included the cession to Russia of the whole of the Karelian Isthmus, the city of Viipuri, the whole

of Viipuri bay with its islands, territory N. and W. of Lake Ladoga, and a number of islands in the Gulf of Finland; both countries pledged themselves to non-aggression; Finland agreed to lease Hanko to Russia for 30 years, with the right to establish a military base there; a new railway was to be built jointly by the two countries to connect Russia and Sweden by a shorter route. The new frontier was approximately that agreed between Sweden and Russia in 1721. Finland lost the port of Viipuri, the defence works of the Mannerheim line, important sawmill, mining,

and water power resources, and factories.

When Germany attacked Russia in June, 1941, Finland joined her, and the Finns advanced to their old frontier, forming a constant threat to Leningrad. But the front here remained quiescent until the Russians launched an offensive early in 1944. Then, on June 10, the Russians attacked in the Karelian Isthmus, capturing Viipuri on the 20th. The U.S.A. broke off diplomatic relations with Finland, June 30, and negotiations began, leading to an armistice between the U.S.S.R. and the U.K. on the one hand, and Finland on the other, signed Sept. 19, by which the Finns undertook to disarm all German troops in Finland by Sept. 15, demilitarise the Aaland Is., provide the Allies with airfields, return the oblast of Petsamo to the Soviet Union (the Soviet Union renouncing its

rights in the Hanko peninsula), pay an indemnity of 300 million dollars over six years, and restore, subject to certain changes, the terms of the treaty of March, 1940. (These terms were confirmed in the peace treaty of 1947.) A German army under Gen. Lothar Rendulic remained in N. Finland, but, cut off from the Gulf of Bothnia, had to retreat through desolate country, in the Arctic winter, pursued by the Russians, assisted more and more actively by the Finns as Rendulic left a trail of flaming villages behind him. The last Germans were driven out in April, 1945.

CONSTITUTION. Finland has a single chamber, the diet or house of representatives, consisting of 200 members elected on a system of proportional representation by all men and women who have reached their 21st year. Women are eligible to sit. The president is elected for six years by an electoral college elected by the citizens. The council of state (ministry) is appointed by the president, but must have the support of the house of representatives. Education has been compulsory from seven to 15 since 1920; 9 p.c. only over 15 are illiterate. There are three universities, one at Helsinki and two (one Finnish, the other Swedish) at Turku. Secondary education is given in lyceums, high and middle schools; there are navigation, commercial, trade, technical, arts and crafts, agricultural, dairy, cattle management, horticultural and forestry schools. More than 96 p.c. of the population belongs to the Lutheran church. Among the rest are a few adherents of the Greek Catholic and the Roman Catholic churches, Judaism, and Islam. Pop. (1950) 4,032,538.

Life and Character of the People

The majority of the people are Finno-Ugric, belonging to the great Ural-Altaic family. Physically strong, hardy, and athletic, they have in general round faces, square shoulders, fair hair, and blue eyes. Their temperament is somewhat phlegmatic, and they are honest, hospitable, and clean. They have a keen sense of independence and personal freedom. Since 1920, prohibition of alcoholic liquors has been in force. They live simply and the food of the peasants is poor, but, except in the N. and E., there is little real poverty. The bath-house attached to every farm is characteristic of the country. The Swedish element of the popula-

tion is found in the towns and in the Aaland Is. The organization of public health is well developed.

INDUSTRIES. Essentially an agricultural country, with some 60 p.c. of the pop. engaged in this branch, mainly in small holdings of less than 25 acres, only about 3 p.c. of the country is under cultivation; about 5 p.c. is grassland. Oats, barley, rye, and potatoes are the chief crops. A little flax is grown. Numbers of dairy cattle are kept; also sheep, goats, and pigs, while Finnish horses have for long been noted for their speed, hardihood, and docility. Minerals are few and of small importance. Manufactures are well developed, mainly by the help of water power. They include engineering, machine making and shipbuilding, pulp and paper making, production of cotton goods, and tanning. Saw-mills number about 1,000. The chief port is Helsinki, after which come Turku, Kotka, and Oulu. The main exports are timber, butter, paper, pulp, and textiles, while the imports include cereals and other foods, cotton, machinery, and coal. Much of the inland traffic is by water, and so well linked by nature or by canals are the country's many lakes that it is among the countries of the world with the most adequate internal communications. The southern half of the country is well served by railways, of which in all there are some 3,500 m., all but about 150 m. state-owned. They are linked with those of Russia and Sweden.

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Finland, GULF OF. Eastern arm of the Baltic Sea, between Finland and Estonia S.S.R. Its length is 250 m. and its average breadth 60 m.; it is studded with islands. Several important towns are on the coast—Tallinn, Leningrad, Viipuri (Viborg), Helsinki. On one of the key islands in the Gulf of Finland is the Russian naval base of Kronstadt, which in the Second Great War played a part in the defence of Leningrad and resisted the attacks of German and Finnish forces.

In Oct., 1941, minefields were laid in the Gulf by the Germans and Finns; but Russian submarines and light craft continued to operate in these waters throughout the war, interrupting supply traffic along the coastal roads, sinking enemy shipping, and landing raiding parties behind the front line. When the Russians advanced through Estonia and Latvia in 1944, their warships based on Kronstadt sank many enemy transports in the Gulf and the Baltic Sea. Under the terms of the Russo-Finnish armistice of Sept., the U.S.S.R. acquired the right to establish a naval and air base in the area Porkkala-Udd, a peninsula about 30 m. S.W. of Helsinki. See Baltic Sea; Kronstadt.

Finlay, ROBERT BANNATYNE FINLAY, 1ST VISCOUNT (1842-1929). British lawyer, born July 11, 1842. He was educated at Edinburgh university, qualified as a doctor, was called to the bar in 1867, and sat in parliament, where he represented Inverness Burghs, 1885-92 and 1895-1906; Scottish universities, 1910-16. A strong Unionist, he became solicitor-general 1895-1900; attorney-general 1900-06. He was lord chancellor under Lloyd George, 1916-18. Made a viscount, he became British member of the permanent court of arbitration at The Hague in 1920 and the next year a member of the international court of justice. He died March 9, 1929, and was succeeded in the peerage by his son William. The latter, born 1875, became a judge of the high court in 1924 and a lord justice of appeal in 1938; he died June 30, 1945.

Finlay, GEORGE (1799-1875). British historian. Born at Faversham, Dec. 21, 1799, he was educated at the universities of Glasgow and Göttingen. He espoused the cause of Greek independence, saw much of Byron at Missolonghi, and finally made Greece his home, never visiting England after 1854. His great work, *A History of Greece from the Conquest by the Romans to the Present Time*, was published complete in 1877, its main parts having appeared in 1844, 1856, and 1861. He died in Athens, Jan. 26, 1875.

Finmark OR FINNMARK. Maritime fylker or county of N. Norway. It is bounded N. by the Arctic Ocean and S. by Lapland, and is the northernmost portion of the European land mass, culminating in the North Cape. Area 18,580½ sq. m. Its rugged coast is indented by bays and fjord

fringed by numerous islands. The surface is elevated, rising to over 3,000 ft. in parts. The climate is severe, and life is hard. Fishing and reindeer breeding are the chief occupations. Hammerfest (*q.v.*) is the chief town. Pop. 53,308, mostly dwelling on or near the coast. Nomad Lapps occupy the interior.

In Oct., 1944, Russian forces pursued the German troops that had retreated from Finland into Finmark. Kirkenes was liberated on Oct. 25. As the Germans retreated, they forcibly removed the inhabitants, destroyed livestock, and burnt the towns of Kirkenes, Hammerfest, Vardö, and Vadsö as well as villages and even isolated farms, leaving the country almost lifeless. Reconstruction began immediately the Norwegian government took charge of the territory.

Finn, FIONN, FIND, OR FINGAL. Warrior hero of Celtic tradition. The legends which gather round his name have almost certainly a real historical figure behind them. Finn was the son of Cumhal (*pron. cool*) of Leinster, and was born after his father's death in battle at Cnucha; first called Demne, he came to be called Finn, the Fair One, from his appearance. He took over the leadership of the warrior band known as the Fians or Fianna from his life-long enemy Goll MacMorna. His sons Oisín and Fergus, his grandson Oscar, his herald Ullín, his favourite hound Bran, were famous figures in his story. One of the chief episodes in his career was the pursuit of Diarmid, who eloped with Grania, Finn's betrothed.

In Scottish legends Finn is known as Fingal, and was king of Morven, in Argyll. He was slain in the great defeat of the Fians at Gabra, probably in 283. His memory has never faded among the Gaelic peoples of Ireland and Scotland. *Consult* Finn and His Companions, S. J. O'Grady, 1892; Gods and Fighting Men, Lady Gregory, 1910.

Finnesburg. THE FIGHT AT. Fragment of heroic Anglo-Saxon poetry, discovered in the binding of a MS. in Lambeth Palace library in the 16th century. It describes incidents of the battle between the Frisian chieftain Finn and the Danes.

Finnish Spitz. *See* Hound.

Finno-Karelia. *See* Karelia.

Finns. A people inhabiting central and N. Russia before the Slavonic dispersion. Hunters and fishers, akin to the tall, blond, blue-eyed Nordic type, they min-

gled in the course of centuries with Alpine rather than Mongolian elements, and are now classifiable mainly by their dialects. These form, with the Ugrian, a branch of the Ural-Altaic family, out of which Aryan probably emerged. Numbering about 6,000,000, they are grouped as Volga, Permian (Votyak), and Baltic Finns. Of the last group the true Finns (Suomi), in Finland and contiguous territories, may exceed 3,000,000. These, having absorbed Swedish influences of race, culture, and speech, display a progressive civilization, a high intellectual attainment, and a passionate love of country. *See* Finland; Mordvin.

Finsbury. London metropolitan borough. Bounded S. by the City, it has the boroughs of Islington on the N., Shoreditch E., and Holborn and St. Pancras W. At one time a manor or lordship, forming one of the prebends of St. Paul's Cathedral, N. of Moorfields, and known as Fensbury, from the swampy nature of the ground, its old fields were practising grounds for military and archers, referred to by Shakespeare and Ben Jonson. Here, in 1548, Protector Somerset was met by the lord mayor on his return from Scotland. Finsbury was once a residential quarter for doctors and surgeons, and it includes Clerkenwell, a clock and watch-making centre. Within its area are Bunhill Fields, Northampton Institute, Sadler's Wells Theatre, and St. John's Gate. With Shoreditch, Finsbury forms the bor. constituency of Shoreditch and Finsbury. Nine-tenths of the houses were damaged by air raids in the Second Great War; about a quarter of the rateable value was lost Dec. 29-30, 1940. Pop. (1951) 35,370.

Finsbury Park. Recreation ground of N. London, the name of which is applied to the district immediately surrounding it, to an important main line rly. junction, and to a station on the Piccadilly line (for long its terminus). Just outside the co. of London boundary, the park (115 acres) is between the rly. and Seven Sisters Road and Green Lanes. It was opened by the metropolitan board of works in

1869, the land costing £56,869 and the laying out about £50,000. It was planned to serve as a recreation ground for the people of the borough of Finsbury.

Finsen Light. Form of treatment for lupus and other skin conditions, invented by the Danish scientist Niels Ryberg Finsen (1860-1904). The rays from a powerful electric arc lamp are passed into an absorbent medium which allows only the actinic or chemically active rays to pass through it. These rays, having been concentrated by means of lenses of rock crystal and cooled by being passed through a continuous current of cold water, are directed on to the affected area.

Finsteraarhorn. Mt. of Switzerland, between the cantons of Berne and Valais. It is the highest

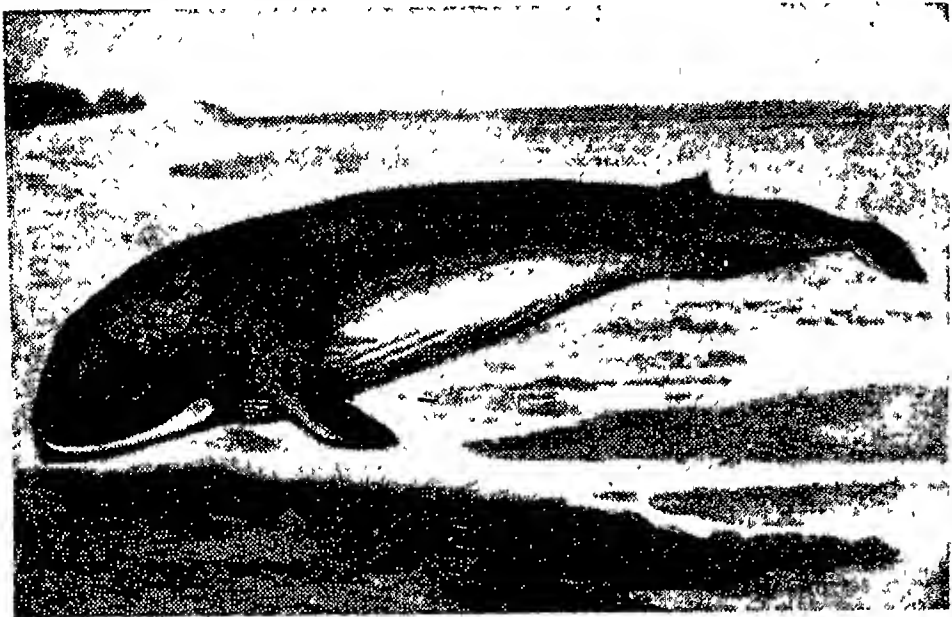


Finsteraarhorn. Switzerland, and the Aletsch glacier. seen from the air

peak of the Bernese Oberland (alt. 14,025 ft.), and extremely difficult of ascent. The summit was first reached in 1812. The Schreckhorn lies to the N. and the Jungfrau to the W.

Fin-Whale OR FIN-BACK (*Balaenoptera*). Name sometimes given to the rorqual, a common and widely distributed whale, of which five species are usually recognized. As their yield of blubber is small and their whalebone of inferior quality, they are not in great demand; this doubtless accounts for their being still found in great numbers in nearly every sea except near the Poles. They are of somewhat slender form, and have a short back fin, and narrow and pointed flippers. They have a large pouch in the throat for the reception of the fish on which they feed; and when this pouch is collapsed the skin of the throat lies in a number of longitudinal folds which are characteristic of the genus.

Of the four species included in the British fauna, the common



Fin-whale. Stranded specimen of rorqual, *Balaenoptera musculus*

rorqual (*B. physalus*) is often met with in the English and Irish Channels and cast up on the coasts. Sibbald's rorqual (*B. musculus*) is the largest of all whales, often exceeding 80 ft. in length. It is abundant in the North Sea, and occurs around the Hebrides. Rudolphi's rorqual (*B. borealis*), much smaller, has been found during recent years around E. and S.E. England. The lesser rorqual (*B. acutorostrum*) is about 30 ft. in length, and fairly common around all British coasts. Bryde's whale (*B. brydei*) is found off S. Africa. See Whale.

Fiord or **FJORD** (Scand.). Type of inlet found on the coasts of regions which have been greatly glaciated. During the ice age great glaciers scooped out deep trough-like valleys with precipitous sides, and the disappearance of the glaciers admitted the sea. A fiord is usually very deep except near the entrance, and sometimes subsidence of the land has added to its size. Fiords occur in British Columbia, Scotland, and Norway.

Fir. Cone-bearing trees of the family Coniferae, and genera *Abies*, *Picea*, and *Pinus*. Natives of Great Britain, N. Europe, N. America, Japan, and the Himalayas, they vary in height from 10 to 200 ft. In gardens firs are best grown as specimen trees on lawns, where



Fir. Foliage of silver fir, *Abies pectinata*

silver fir. The genus *Picea* embraces the spruces, and *Pinus* the pines. Firs are cultivated for their timber. See illus. p. 1325.

Firando. See Hirado.

Firbolg. Legendary name of an early Irish people, usually said to mean bag-men. Some ethnologists use it to denote the aboriginal



Fiord. View in the Naero Fiord, Norway; above, typical cliff-walls of a fiord

people of Ireland who were mainly dark-haired, long-headed Iberians and were subdued by the Milesians, perhaps a wave of Goidelic Celts from neighbouring Britain.

Firdausí or **FERDUSÍ.** Pen-name of Abú'l Kásim Mansúr (c. 940-1020), Persian poet, called the Homer of the East. He was born at Schadab, near Tús, Khorassan, son of a small land-owner. Carefully educated and an apt scholar, he is famous as the author of the *Sháh-Námeh*, or Book of Kings, a metrical history of Persia from early times to A.D. 641; and *Yûsuf u Zúlikhâ*, a poem

their beauty can be fully appreciated. They thrive in any deep, rich loam, may be planted in autumn or spring, and are propagated by seeds sown in a cold frame in spring. Much confusion in nomenclature exists among these conifers, but it is now generally accepted that the true fir means *Abies*, the

on Joseph and Potiphar's wife. The first-named work, in 60,000 couplets, was commissioned by Mahmúd, sultan of Ghazni, who promised 60,000 gold pieces as a reward. Firdausí, however, excited the enmity of Mahmúd's vizier, and when, at the end of his task, which occupied him for 30 years, the vizier sent him pieces of silver instead of gold, the indignant poet divided the money between the keeper of a bath, a sherbet seller, and the vizier's messenger, penned a flaming satire on Mahmúd, and, after spending the remainder of his life a proscribed man, died at Tús. According to legend, as his body was being borne to the grave, a messenger laden with 60,000 gold dinars from Mahmúd arrived, and, as Firdausí's daughter refused the money, it was spent on some much-needed public buildings in Tús.

The *Sháh-Námeh*, which has been described as the *Iliad* of Persia, is characterised by its Persian vocabulary, the simplicity of its style, its high qualities of invention, its original transcripts from nature, its patriotism, its dramatic dialogues, and its reflection of the author's Zoroastrian faith. Battles, combats, feasts, scenes of riot, and carnage alternate with pictures of innocence and peace. Much is taken up with the wars of Persians and Tartars, and one of the central characters is Rustum, the Persian Hercules, who unwittingly kills his own son, an episode familiar to modern readers in Matthew Arnold's poem, *Sohrab and Rustum*.

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Fire. Visible effect of the combustion of substances by means of the chemical combination of atmospheric oxygen with one or more of their constituents. The incombustible residue is called ash. Flame is formed when glowing gas is produced, either as a primary or as a secondary result of the burning. There may also be non-luminous vapours called smoke or fume.

The process of raising the temperature of combustible or inflammable substances to the point at which self-sustaining combustion proceeds is called ignition. This may be brought about by solar radiation, terrestrial heat, molecular action, electrical discharge, friction, pressure, or percussion. Fire may be extinguished before combustion is completed by reducing the temperature of the burning mass below the ignition point, or by stopping the access of air. In the domestic and industrial arts heat and light are commonly obtained from substances—solid, liquid, or gaseous—called fuels, mostly derived from carbonaceous materials of vegetable origin.

Early Theories of Combustion

Medieval alchemy pictured the world as composed of four elements: fire, water, earth, and air. When modern chemistry began, Boyle, while still holding fire to be a material element, discovered that air is essential to combustion. A theory propounded by Stahl, that combustible bodies contain a substance called phlogiston, which is released by their decomposition, was not exploded until Lavoisier, after discovering oxygen, explained burning as caused by the extraction of this gas from air and its combination with other substances.

The anthropological theory that early man was a fireless animal is supported by the fact that every primitive mythology has its own account of the origin of fire and of the discovery of its benefits by mankind; in general it is described as a gift of the gods. In Greek mythology, Prometheus brings down a torch lighted at the sun; according to the Vikings, Ukho struck a stone with iron and brought forth lightning; amongst the ancient Egyptians, Phoenicians, and Slavs, there existed fire-gods who personified the diverse functions of fire. The identity between life and fire was an elemental idea amongst the Romans, Persians, Hindus, and Red Indians. The gods of fire possessed variable qualities, *e.g.* the cruelty of Moloch and the beneficence of Hestia.

Traces of fire appear among human relics as far back as early Palaeolithic times. Except the Andaman Islanders, it is doubtful if any race or tribe has been completely without some knowledge of fire. Man's discovery of fire, and his ability to make and use it for his own benefit, marks the dividing line between animal and human existence. Perhaps in the form of burning lava from volcanoes, or from vegetation set on fire by lightning, fire was acquired and preserved for the most primitive use conceivable: for protection from beasts and for elementary cooking. The next stage was the invention of creating fire at will, either by friction of wood, as in the fire drill, saw, or plough, or by the percussion of minerals, as with flints and pyrites.

Communal Fires

With the necessity of preserving fire, man became sedentary and was obliged to live in groups; this gave rise to the social instinct, and to the use of fire for warming the person, cooking foods, hardening implements and utensils, and producing artificial light. Hence primitive man found it convenient always to have a fire burning in some protected place, which ultimately developed into a public building round which centred all religious, civil, and political activities. This principle of an ever-burning fire was observed by civilizations as diverse as the Egyptian, Greek, Roman, and Aztec. When the fire of Vesta at Rome went out, all business was suspended until it had been rekindled with appropriate ceremony. No Greek or Roman army would cross a frontier without carrying before it a fire lit from the sacred flame. Fire played a part in the ceremonies observed by ancient and primitive peoples during the initiation of boys into manhood. Most ancient and modern religious beliefs hold that the world will eventually be destroyed by fire.

Uncontrolled fire is the prime destructive agent of man's labours, and throughout history has destroyed more natural and built property than have all the wars combined. Despite the efficiency of modern fire-fighting and prevention methods, fire continues to take heavy toll of life and property; in Great Britain annual losses from fire total £13,000,000 and in the U.S.A. £85,000,000. Vast tracts of valuable timber are annually lost in the forest fires of Canada and the U.S.A., while bush

fires in Australia, and even heath fires in the U.K., are responsible for much destruction. Most of these fires are caused by spontaneous combustion, but many are the result of carelessness. The wasteful method of clearing scrub land for cultivation by burning the bushes and trees destroys quantities of timber in India.

Sometimes property is fired maliciously, a felony punishable in England as arson and in Scotland as fire-raising. Much evil is wrought by thoughtless or unintentional incendiarism. Out of these perils have arisen the organized services concerned with fire precautions, proofing, prevention, extinction, and insurance.

Two of the most destructive fires of ancient times were those of Rome in A.D. 68, and Alexandria in the 7th century. The Great Fire (*q.v.*) of London in 1666 was one of the greatest conflagrations on record in time of peace. Other destructive fires were at Chicago, 1871; Boston, 1872; Baltimore, 1904; San Francisco, 1906; Yokohama and Tokyo, 1923; Wapping, London, 1935; Marseilles, 1938; Barbican, London, 1939.

The U.S.A., Canada, Australia, and New Zealand have been much more conscious of the dangers of fire, and more advanced in protective measures, than older nations. This is because in new countries buildings were invariably of wood. Many early towns in the New World still contain a high proportion of timber buildings, and in the event of large fires the damage is always serious.

Use in Offence and Defence

Like many inventions, fire was turned to warlike purposes soon after man adapted it to his use. In primitive tribal fighting, a prime object was to set alight the enemy's villages. This was achieved by flaming arrows, and, later, by the throwing of pots of incendiary chemicals, *e.g.* Greek fire. Fire later developed into a means of defence, either to delay an enemy's advance or to deny him the fruits of his victory; a notable example was the burning of Moscow by the Russians in 1812. During the Second Great War, the 'scorched earth' policy of the Russians and Germans in retreat hindered the enemy's advance. But fire did not become a controlled and accurate weapon before the development of the flame thrower and incendiary shell, bullet, and bomb in the First and Second Great Wars. (*See Flame Weapons; Incendiary Weapons.*)

It has frequently been used in simpler forms as a political weapon, notably by the Fenians, suffragettes, I.R.A., and I.W.W.

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Fire Alarm. Mechanical device for making known the fact that a fire has broken out. Fire alarms are of two types, the manual and the automatic. The most common manual fire alarm is the street "break - the - glass - and - pull - the-knob" variety. These alarms are connected to a switchboard in the nearest fire station. When the alarm is pulled, a bell rings in the watch room of the station, and an indicator lights up on the board to show the position of the alarm from which the call comes.

Matter is expanded by heat, and this principle is used in all automatic fire alarms to actuate a mechanism which rings a bell outside the building in which a fire breaks out. The mercurial type consists of a thermometer with platinum wires entering the bulb and the top of the tube through fused joints. When the mercury rises to a certain height it completes the circuit of which the wires form part, and a bell rings. An adjustable form has the top of the tube open and a sliding upper wire.

Pneumatic alarms are operated by the expansion of air in a closed tube or vessel, and the pressing out of a diaphragm which brings a moving contact against a fixed contact. One variety has a bowl-shaped container with a concentrically corrugated top. The chamber is partly exhausted and then sealed. An alarm is given if the air inside be expanded by heat, or the chamber leaks and the vacuum is broken; in either event the diaphragm bulges outwards. In another variety air at atmospheric pressure is contained in a small chamber and in very fine tubes running from it round the walls of the apartments in which it is installed. The air in the tubes is heated quickly by a fire and communicates its pressure to the main chamber.

Metallic fire-alarm contacts employ two metals of unequal expansibility. A common form consists of a bar, compounded of a strip of steel and a strip of copper welded together, or otherwise

rigidly joined, fixed at one end and free to move at the other. When the bar is heated the copper expands more than the steel, and the bar curves towards the steel side, bringing the free end against a contact.

The May-Otway alarm has a horizontal steel bar several feet long, to the ends of which the extremities of a piece of copper wire are fastened. A contact-piece hangs from the centre of the wire. The bar and the wire form together a very obtuse-angled triangle. If the temperatures rise slowly—on a hot day, for example—the steel bar takes in heat as fast as the copper wire and their relative lengths are changed but slightly, whereas a sudden influx of heat affects the wire much more quickly than the bar, and the wire droops sufficiently to let its contact-piece touch a contact below.

Another automatic alarm has a glass bulb filled with liquid in which is trapped a bubble of gas. Increasing heat causes the liquid to expand and shatter the bulb, so releasing a valve, which has been held compressed by the pressure of the air in the bulb. Release of the valve closes an electrical circuit and rings a bell. The bubble of gas in the bulb before it is shattered prevents the alarm from functioning through changes in the weather. Most automatic alarms simultaneously bring into operation a system of chemical or water sprinklers designed to hold the fire in check until the arrival of the fire brigade. (See Fire Prevention.)

It is a criminal offence to give a false alarm of fire to a fire brigade, whether by a street fire alarm or by message. The maximum penalty is a fine of £25 in London and £20 elsewhere.

Firearms. Generic designation of weapons which throw a missile by virtue of the propellant power generated by a charge of suitable explosive. While popular use is inclined to restrict the term to such weapons as can conveniently be used by hand, such as rifles, sporting guns, and pistols, these are more correctly termed small-arms (*q.v.*), and firearms includes even the largest artillery.

The history of firearms is, naturally, closely associated with that of explosives, but there is no doubt that in early times progress was far more dependent on the smith than the powder-maker, as the latter was always in a position to supply a more powerful explosive than could be used with safety in contemporary guns. The invention

of firearms is usually ascribed to a German monk, Berthold Schwarz, but the date is not definitely known. From illustrations and accounts in contemporary manuscripts, it is evident that guns were in use by 1320, and the English used them at Crécy, 1346. These were either bottle-shaped or tubular in form, and at first were employed to fire darts with either metal vanes or a leather pad in place of feathers, but spherical shot were early introduced, being usually made of stone, as the guns would not withstand the charge necessary to propel the heavier metal missiles.

The early guns were generally built up of wrought iron strips welded together, but some consisted of wooden staves bound with iron, and all were valued far more for the moral effect occasioned by the noise of their discharge than for the material damage caused. "Hand guns," which appear to have come into use about 1400, were merely smaller sizes of cannon mounted on a rough wooden stock, and all weapons were discharged by applying a piece of smouldering match to the touch hole.

Invention of the Flint Lock

The next improvement was the invention of the matchlock about 1460, and it was not until the invention of the flint lock early in the 17th century that this was generally superseded. Flint locks remained supreme until early in the 19th century, when percussion caps were introduced. During this time the only improvement in cannon was better construction, they were cast in bronze in the 15th century and in iron by the 18th. The advent of the wheel lock (*q.v.*) in 1515 had also made it possible to produce a practicable pistol, so that three distinct varieties of firearm, cannon, musket, and pistol, were in existence.

In order to increase the accuracy of weapons, rifled barrels were introduced about 1520, probably by August Kotter of Nuremberg, but the slowness of loading from the muzzle end with this type of weapon restricted its use to sporting weapons until the end of the 18th century when a few regiments of marksmen were formed. Not until breechloaders were definitely established did the rifle supersede the musket.

Breechloading guns have been known for some centuries. Henry VIII had a sporting weapon of this type, but the Prussian needle gun of 1841 was the first weapon in which the principle was applied

with any real success. With a view to increasing the rapidity of fire, double-barrel guns were introduced about the middle of the 17th century, magazine rifles about 200 years later, one of the earliest being the Winchester, 1867. Revolvers date from 1835 (Colt).

After 1880 improved construction and the advent of smokeless powder made possible the manufacture of weapons of great power and extreme accuracy; improved breech blocks and the absorption of the recoil by hydraulic buffers revolutionised artillery practice; through the use of the force of the recoil to reload, cock, and fire the weapon, machine-guns were produced which would fire 600 shots per minute.

Developments during the First Great War were in giving mobility to larger guns and howitzers; in the use of guns of immense power as instanced by anti-aircraft artillery and the German gun having a range of 80 miles, which threw 9.1-in. shells, weighing about 3 cwt. each, into Paris; the introduction of new types of ammunition; and the use of trench mortars, which were extremely light cannon, generally smooth-bored and often muzzle-loading, capable of firing heavy projectiles to short and medium ranges. In the Second Great War automatic firearms like the Thompson sub-machine-gun and the Sten carbine were used on a large scale. A further innovation was the rocket gun.

Under the Firearms Act, 1937, no person may normally have in his possession any firearm—except a smooth bore gun with barrel not less than 20 ins. long or an air gun, air rifle, or air pistol of a type not declared specially dangerous by the home secretary—unless he holds a firearms certificate. Such a certificate can be obtained for 5s. from the police, but the applicant must show good cause for having a firearm. A certificate remains in force three years. If the police refuse to grant one, an appeal can be brought to the court of quarter sessions. Among the persons to whom this restriction does not apply are crown servants, persons taking part in theatrical performances or films, starters of races, operators of miniature rifle ranges, and members of rifle clubs and cadet corps. Automatic weapons are forbidden. Firearms dealers must be registered. *See* Ammunition; Arquebus; Bullet; Cartridge; Explosives; Machine-Gun; Ordnance; Pistol; Revolver; Rifle; Trench Mortar.

Fireback. Back wall of a fireplace, introduced about the middle of the 16th century as a protection for the walls. Firebacks were of cast iron, often elaborately decorated with designs of flowers, figures, etc., in high or low relief. The most interesting series were those with coats of arms and other heraldic devices, with inscriptions.

Fire Brat. *See* under Silver Fish.

Firebrick. Term for heat-resisting brick used in the construction of furnaces, commonly restricted to bricks made from fireclay (*q.v.*), others being called by the predominant constituent in their composition, *e.g.* silica-, chrome-, magnesite-bricks. Pulverised fireclay is mixed with water and pressed into moulds. The bricks are then slowly dried and fired strongly in special kilns.

Fire Brigade. Organization for combating outbreaks of fire. There apparently existed fire brigades in Egypt 4,000 years ago; an elaborate organization operated in Rome by 40 B.C. Early in the Christian era hose pipes appear to have been in use. For British practice, *see* Fire Service.

Fireclay. Material so called from the high refractoriness of the articles made from it, *i.e.* its quality (when manufactured) of resisting intense heat, and its freedom from splitting when exposed to rapid changes of temperature. The determining factor of the refractoriness is the chemical composition of the clay, which contains but small quantities of fluxing impurities (such as iron, lime, magnesia, alkalis), and little free silica. Fireclays should dry and fire without cracking and have an open texture to resist alternate heating and cooling. In the manufacture of some fireclays sawdust is mixed with the clay and is burnt on firing, leaving the open porous texture required. The minimum fusion point for a fireclay is usually taken at about 1,600° C.

Fireclays abound in the British coalfields, underlying or alternating with coal seams. They usually contain 50–70 p.c. silica and 20–30 p.c. alumina, the remainder being iron oxide, lime, magnesia, soda and potash. The beds do not usually exceed 2 ft. in thickness, and the presence of rootlets, coupled with the absence of alkalis, suggests that they represent the soil in which the coal measure forests grew—the plant debris formed the overlying coal seam. Deposits are worked in Cornwall, Devon, Dorset, and elsewhere in

the S. of England. Fireclay from Stourbridge, said to have been worked in the 16th century, is exported in quantity on account of its excellent qualities. *See* Brickmaking; Firebrick.

Fire Control. System under which two or more pieces of artillery are ranged or fired on a specific target under the individual command of an officer. During the Second Great War, fire was controlled in field artillery either by an officer in an advanced observation post who transmitted his fire orders to the battery by telephone, or by an observer in an aircraft who was in radio communication with the artillery. Anti-aircraft artillery was controlled by data as to bearing, height, range, and speed of the target set into a predictor (*q.v.*) after the picking up of a target on a radar screen. One master predictor controlled the fire of a number of guns.

In warships, fire was controlled from the citadel or control tower in battleships and cruisers and from the bridge in smaller vessels such as destroyers. From this control position the gunnery officer directed the vessel's guns either from personal observation of the target or from messages received from spotting aircraft. If necessary, the fire control officer could fire all the main armament simultaneously by pressing a switch. The development of radar revolutionised fire control for both land and ship-borne artillery, making it possible to control accurate and sustained fire against a target which might be moving under cover of thick smoke or fog. *See* Artillery; Gunnery.

Firedamp. The name given to the most important of the gases which are found occluded in the crust of the earth, *viz.* methane, or carburetted hydrogen (CH₄), which appears in coal mines. When diluted with air in certain proportions it forms a mixture which will explode with great violence when ignited by a flame or spark, or by an incandescent surface. Such an explosion occurring in a coal mine may kill the workers directly by mechanical violence or by burning, or indirectly by carbon monoxide poisoning, since carbon monoxide is formed by the incomplete combustion of the gas.

Firedamp and marsh gas have the same composition, and both are formed by the decomposition of vegetable matter. Coal beds are porous and the gas accumulates in their pores, but large volumes sometimes accumulate under con-

siderable pressure in pockets, and when these pockets are tapped by a pick or a drill, or by a fall of coal or rock, the gas escapes into the mine workings and becomes a source of danger. A fall in the barometric pressure tends to release the gas: hence the importance to miners of weather forecasts. The volume of methane is sometimes so great that when a pocket of it is tapped the gas issues in a continuous stream or "blower" for several years. Attention is being given to the possibility of recovering methane (which is used as a fuel in the form of "bottled" gas; see Gas) from such sources. As a natural product of the coal measures, methane occurs in a remarkably pure state, containing less than 3 p.c. of other gases. All mixtures ranging from about 4 p.c. to about 14 p.c. of methane and air are explosive, but, by means of the flame safety lamp, the miner can detect the presence of less than one p.c. of firedamp in the mine air by observing the height of the pale-blue flame of burning methane above the oil flame.

Fire-eating. Branch of the juggler's art. It includes exhaling or swallowing flame, holding red-hot iron between the teeth, drinking molten substances, and similar pretensions. A writer of the 2nd century described breathing from the mouth of flame and smoke as arising from inflammable matter inside a nutshell wrapped in tow. In 1672 Evelyn saw Richardson chew and swallow glowing coals and brimstone, besides pouring molten lead—perhaps cold quicksilver—on his tongue. In 1762 Strutt saw Powell broil a piece of beefsteak upon his tongue with glowing charcoal placed beneath it. In 1814 Josephine Girardelli claimed to put molten lead into her mouth and to spit it out marked with her teeth. These effects were produced partly by utilising unfamiliar physical and chemical principles, partly by the performer's sleight of hand.

Fire Engine. Machine for extinguishing a conflagration. In 1650, Hautch of Nuremberg made a manually operated fire engine, but it was not very successful. A few years later Jan van der Hydens of Amsterdam invented an improved engine, adding to it later an air vessel and a combined pair of bucket and plunger pumps, the connecting rods to which were attached to a cross lever. The air vessel prevented shock and loss of power, and made it possible for the pumps to give a continuous

stream of water which was delivered through a branch and nozzle fitted to the delivery side of the pump. About 1670 the Dutch invented riveted leather delivery hose. These machines were fed from a cistern which had to be kept filled from buckets.

The first manual engine built in England is credited to Richard Newsham of London about 1724. It incorporated improvements by which water was sucked through a pipe line to feed the pump. A steam fire engine is said to have been made in England in 1829, but not until 1861 was the first horse-drawn steam fire engine adopted by the Metropolitan (London) Fire Brigade. The pump was a single throw piston type fitted horizontally on a carriage, the power to operate the pump being steam generated from a quick heating boiler. Later models had two double acting reciprocating pumps fitted vertically, driven by steam power; forced draught gave sufficient head of steam within 10–15 mins. of lighting the fire under the boiler. Steam propulsion was substituted for horses in 1902, and a year or so later the internal combustion engine superseded steam, a rotary pump being coupled to the driving shaft by means of gearing. The centrifugal pump was introduced in 1906; its impeller shaft was driven by intermediate gearing or belting by any available motive power. Like the subsequently developed reciprocating pump with three throw action, the pistons being in series, it was fitted into a chassis which was either towed behind another vehicle or had its own mechanical propulsion. See Pump.

Fire Escape. An appliance to assist the escape of persons who are trapped in a burning building. Fire escapes can be divided into two categories, those owned by the general public, and those owned by a fire brigade. Among the first are: (a) a rope ladder with wooden rungs permanently fixed under the window in a room and generally encased in a box; (b) a reinforced line fitted with a hook at one end to which a sling can be attached, the other end of the line being wound on a drum (with braking device to regulate the speed of the descending person) and enclosed in a metal container with a hook by which to hang it to a permanent fixed ring just inside or outside a window frame; (c) permanently fixed iron or other non-combustible staircase attached to and outside a building, accessible

from each storey by doors opening outwards, and either open or entirely enclosed in brickwork or other non-combustible material; and (d) an entirely enclosed staircase built inside a building as part of its general structure. Enclosed stairway escapes usually have fire-resisting doors on each floor, and are made, as far as is possible, smokeproof. Building by-laws in most cities require the provision of an external fire escape on all buildings having a floor more than 50 ft. above pavement level or occupied by more than 20 persons, and on all factories or workshops employing more than 40 persons.

Portable fire escapes were introduced in 1836; by the Society for Protection of Life from Fire, and were stationed with their attendants in streets of London and other towns. Eventually these escapes were taken over by the fire brigades. They were replaced in time by escapes comprising a series of extending ladders in three sections mounted on a two-wheeled sliding carriage. The ladders were lowered or raised by means of cables and a winch, which was usually mounted between the levers. This type of escape could be propelled by four men; or it could be carried on a fire brigade vehicle and unshipped when required. In cities and large towns fire brigades also have mechanical turntable, self-supporting ladders, some of which can be extended to 150 ft., mounted on a self-propelled vehicle whose engine is geared to a mechanism for extending, lowering, elevating, and rotating the ladders.

In the U.S.A. fire brigades use "aerial" ladders: these, mounted on a turntable swung by hand, and locked by a pin in the desired position, are extended by means of an endless chain and elevated by screw gear, both operations being carried out by hand.

Another fire brigade rescue appliance is the hook ladder, a short light ladder about 16 ft. long fitted with a folding hook, by the use of which firemen can scale a building of any height. These ladders are not intended to be used by persons other than firemen, who with their help fix lifelines to the upper storeys of burning buildings.

Fire Extinction. In principle, the limitation of factors causing fire. Such limitation can be effected in various ways, according to the nature of the fire. These include drawing off burning liquid

fuel when stored in tanks, the demolition of adjoining buildings containing combustible materials, the digging of trenches in heath fires, the removal of cargo from ships' holds, smothering to prevent air from feeding the fire. A container of burning oil, for instance, can usually be extinguished by putting an asbestos sheet over it, and at the same time cooling the exterior of the container with water. A person whose clothing is on fire should be made to lie on the ground and wrapped in a heavy rug. In general, water can be used for cooling, but it must *not* be used in dealing with burning magnesium, certain liquid acids, some alkalis, etc.

FIRE EXTINGUISHERS. Apparatus for extinguishing fire is of five types projecting respectively water, foam, vapour forming liquids, dry powders, and emulsions. Soda-acid machines generally consist of a container holding water and bicarbonate of soda with an inner receptacle holding liquid acid; when operated the chemical reaction between soda and acid creates an internal pressure that expels the liquid from the nozzle. In other types, a compressed gas takes the place of the acid; when the inner container is pierced by mechanical means this gas develops pressure in the receptacle, expelling pure water from the nozzle.

The foam hand extinguisher, similar in appearance to the soda-acid type, has separate combined chemical solutions, the inner compartment being charged with aluminium sulphate dissolved in water and the receptacle itself with bicarbonate of soda and saponin, liquorice, or turkey red oil dissolved in water. When operated the appliance projects liquid "foam."

Extinguishers expelling a liquid which vaporises rapidly when in contact with burning material may hold either carbon-tetrachloride or methyl-bromide (both fluids being non-conductors of electricity). Machines containing carbon-tetrachloride can be operated by (a) pump, (b) compressed gas, or (c) air-pressure. In methyl-bromide machines, a total discharge is given by piercing a copper disk with a pin, control discharge by a spring loaded plunger controlled by a trigger, or a wheel valve and cock.

Carbon dioxide (CO_2), compressed into a cylinder in a liquefied state, when released by a valve vaporises; it is a non-conductor of electricity, and is useful for deal-

ing with fire of highly inflammable liquids at any early stage.

Dry powder extinguishers generally consist of finely ground bicarbonate of soda with precipitated chalk, whiting, sand, sawdust, fuller's earth, or dry pulverised clay. Powder extinguishers containing graphite and other finely ground chemicals have been developed to deal with incipient fire in particular materials, but are not suitable for household use. Emulsion extinguishers also are designed chiefly against special fire dangers in industrial premises.

The handpump or stirrup pump may be either single or double acting. The pump is placed in a receptacle containing water, and a length of hose is attached to the pump. Generally two operators are required, whilst a third person is needed to obtain further supplies of water. Garden hose fitted with a nozzle to a water-tap is easier to use. A siphon of soda water is useful for very small fires.

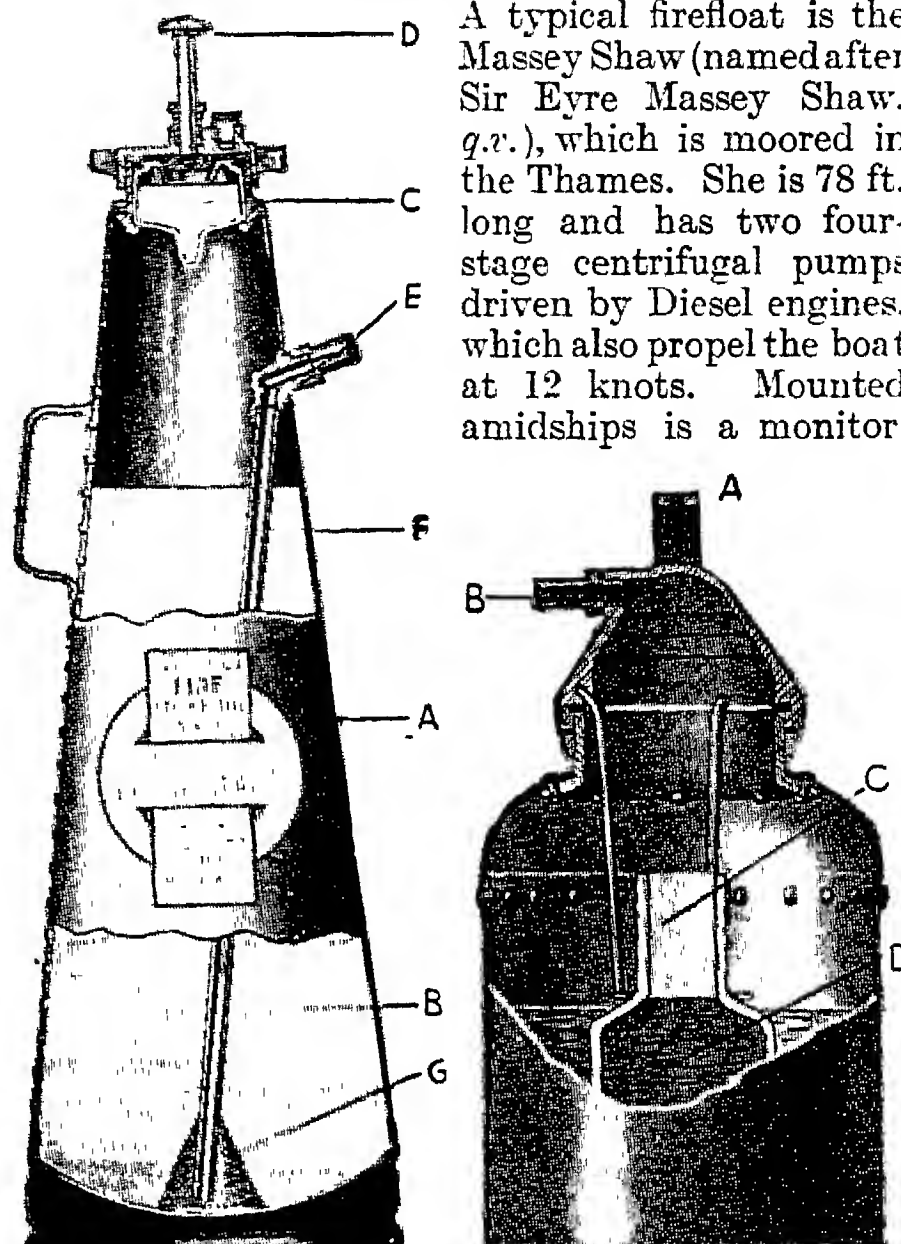
In large buildings and factories with inflammable contents an automatic sprinkler system is common. Piping at ceiling level is installed throughout the building; attached to the piping at equidistant points are sprinkler heads fitted with fusible links which melt at a predetermined temperature, thus opening a valve which emits a continuous spray of water. The area covered by each head depends upon its height above floor level and the pressure under which the water is discharged. The water is supplied by gravitation from a large storage tank in the highest point of the building.

In a building where trained staff are employed, on each floor sometimes stand fire hydrants opened by means of a wheel valve, when the hose and nozzle are connected to the hydrant it is often possible to cover the whole area of the floor. The hydrants are supplied either

by gravitation from a storage tank, or by means of rising mains from street level.

Firefloat. Motor vessel equipped for extinguishing dock, riverside, or ship fires or any fire which cannot be reached by wheeled pumps.

A typical firefloat is the Massey Shaw (named after Sir Eyre Massey Shaw, *q.v.*), which is moored in the Thames. She is 78 ft. long and has two four-stage centrifugal pumps driven by Diesel engines, which also propel the boat at 12 knots. Mounted amidships is a monitor,



Fire Extinction. Left, soda-acid extinguisher: A, steel vessel charged with, B, solution of sodium bicarbonate; C, glass bottle containing sulphuric acid, shattered by striking knob, D; E, jet, connected by tube, F, to base of extinguisher; G, strainer to prevent glass fragments from obstructing jet. Right, foam extinguisher: A, handle; B, nozzle; C, glass container; D, acid
Courtesy of Mather & Platt, Ltd.

or water gun, which can deliver $1\frac{1}{2}$ tons of water a minute drawn from the river by the pumps. On each side of the deck above the engine room is a swivelling delivery head, each with four hose connexions. At the great Wapping fire in 1935, the Massey Shaw pumped continuously for six days. She was one of the ships sent to Dunkirk to assist in the evacuation of the B.E.F. One of the largest firefloats in the world is the Fire Fighter of New York; she is 134 ft. long, and has nine monitors giving a total water output of 22,000 gallons a minute at a pressure of 150 lb. per sq. inch.

Firefly. Name given to luminous beetles of the family Elateridae, found in the tropics. The European glowworm (*q.v.*) is a different kind of beetle, belonging to the family Lampyridae.

Firefly. Two-seater fighter reconnaissance aeroplane designed by the Fairey Aviation co. for the Royal Navy. It operated from

aircraft carriers. It was powered by the Rolls-Royce Griffon engine, and had a span of 41 ft. 2 ins., length 37 ft. 11 ins. Maximum speed of the Mark IV was 386 m.p.h. Coming into production late in the Second Great War, the Firefly served in all theatres of operations.

Fire Guard. Branch of British civil defence in the Second Great War. It was established by an order in council of Aug., 1941, whereby men between 18 and 60 were made liable to compulsory enrolment as fire guards where the Fire Prevention (Business Premises) Order was applied. A month later, all male British subjects between 18 and 60 were obliged to register for fire detection and prevention service. The only civilians excused fire guard duty were members of the Royal Observer Corps, police and special constables, doctors, seamen, and blind and insane persons. In 1942, liability for fire guard service was extended to women between 20-45, and the age limit for men was raised to 63. At the same time members of the Home Guard, part time civil defence personnel, police, and the Royal Observer Corps had to perform a specified number of hours of fire guard service.

Fire guards were given protective helmets and brassards, and were at first linked with the wardens' service, but on Jan. 28, 1943, they became a separate body called the Fire Guard Service, and worked in cooperation with the National Fire Service. Each N.F.S. station area was subdivided into fire guard sectors, each under the control of a Fire Guard section captain, the latter being usually appointed by the local authority. The fire guard sectors were further subdivided into street or block party areas, each with 20-30 fire guards under a party leader.

When the service was suspended on March 24, 1945, it had a strength of nearly 5,000,000 men and women.

Firelock. Musket in which the means of igniting gunpowder was by flint and steel. Adopted in England c. 1690, it replaced the matchlock, which required a burning match to discharge it. The drill command "Shoulder your firelock" was used before "Shoulder arms" came into use. It was also known as Flint Lock (*q.v.*).

Fire-making. Intentional production of flame, spark, or glowing heat. Of primeval invention, it

became one of the mightiest factors in human culture. Natural manifestations of fire were doubtless feared before man perceived its beneficent possibilities. Use gave rise to preservation, preservation to production at will.

Fire-making may have originated in wood-friction. A Moustertian beechwood fire twirl (Tylor's fire drill) was found in 1904, at Krapina, in Croatia. Fire twirls are rotated between the palms in Australia, as in ancient India and Mexico, are aided by a cord by the Maoris, and by a bow in early Egypt; they are gripped by the teeth by the Eskimo, and weighted with a spindle-whorl by the Chukchi. Other frictional appliances are stick-and-groove fire ploughs rubbed along the grain in Polynesia, and fire saws rubbed across the grain by the Malays. A pneumatic fire piston is peculiar to modern S.E. Asia. The primeval percussion implement—strike-a-light—resulted from flint-knapping, and flint and pyrites developed into the early iron-age flint and steel.

Firenze. See Florence.

Fireplace. Recess in the wall of a room, formerly consisting of an open space walled on three sides by stone or bricks, but now generally fitted with a metal fitting, which contains a fire for space heating. The earliest form of fireplace is commonly believed to have been the hearth in the centre of a room, but there is evidence that the wall fireplace has an equally long ancestry. In the Norman keep, for example, where the rooms were placed one over the other, wall fireplaces were the rule, since a central hearth in any but the topmost room would have been an impossibility.

Extant specimens show that these fireplaces were recesses in the wall surmounted by round arches. There was no chimney shaft; the smoke escaped by a short flue leading almost directly to a small vertical opening in the outside wall, concealed in the angle of a buttress. In one-storeyed buildings the central hearth was often used, and this type of fireplace persisted until late in the 16th century. The great hall at Richmond Palace, and the hall at Penshurst Place, Kent, retain examples.

The opening in the roof, through which the smoke was carried, was protected by a small turret, or louvre, which kept out the rain while allowing the smoke to escape. Chimney shafts began to appear about the middle of the

13th century, but were not carried above the level of the eaves until considerably later, and it was not until Elizabethan times that the chimney stack was developed as an architectural feature. Then the number of fireplaces in each house greatly increased, and this called for a corresponding enlargement and beautification of stacks to contain the flues.

Gothic fireplaces are generally treated in the simplest manner. The hood, sometimes with corbels, is the chief and only decoration of most 13th century fireplaces, and the single square-framed arch which followed it was equally devoid of ornament. The Renaissance brought the architectural chimney-piece and elaborate overmantel, and though there was a return to greater simplicity in the Later Renaissance, the taste for a decorated fireplace had taken firm hold. See Building; Chimney-piece illus.; House.

Fire Prevention. Fire prevention begins with the education of the public to avoid acts likely to start fires. Brigade records show that most fires result from the careless use of matches and the discarding of lighted cigarette ends. Fires frequently start in rubbish, which should always be placed in metal containers, and should be periodically cleared from cellars, attics, and other out-of-the-way places, where accumulations of old boxes, furniture, and paper feed a fire once started. Oily rags and certain other sorts of waste material may ignite spontaneously.

Portable stoves and heaters should be placed on non-combustible bases well away from woodwork. Gas rings should be placed on a sheet of metal over a sheet of asbestos if they are used on a wooden table or shelf. A ventilated thimble providing adequate air space between thimble and woodwork should be used when an iron stove pipe passes through a floor or other partition of wood. Gas fires should always be fitted with solid metal piping, and gas rings with flexible metallic tubing with screwed metal connections. The containers of oil stoves should be free from leaks, and oil stoves and lamps should never be filled in the presence of naked lights. Regular cleaning and general overhauling of all these appliances are necessary.

Petrol, benzine, and similar volatile liquids should be handled with great care. It is an extremely dangerous practice to clean clothes

with petrol, etc. The use of naked lights should be prohibited in garages.

Fires in fireplaces should be raked out if the room in which they are burning is to be left empty for any lengthy period. Burning coals should not be moved from one fireplace to another. Hot ashes should be placed in metal dustbins. It is dangerous to pour paraffin from a can on to a sulky fire to make it burn. Tops of ovens and stoves should be kept free from grease, and chimney flues regularly swept.

Fire Hazards in the Home

Electric appliances, *e.g.* irons and kettles, should be switched off when not in use, and damaged flexible cord should be renewed. Flexible cord should not be hung on nails or hooks, and it is unwise to fit any paper or fabric shade nearer than two inches to any electric bulb. The fuse is the safety valve of the electrical system, and when blown should not be replaced by a fuse wire giving higher amperage, or by anything except fuse wire.

The unprotected flames of gas or candles should not be placed near windows where curtains can blow on to them. Pendant gas lights require ceiling shields. Swinging gas brackets should not be used. Candles should be fitted in proper holders.

All heaters, whether electric, gas, or coal, should be protected by a metal guard, to prevent contact with light fabrics that catch fire easily. Many fires are caused by airing clothes too close to a fire. A naked light should never be used to look for a suspected gas leakage; the main cock at the meter should be turned off and word should be sent to the gas supply office. Heath fires are caused in dry weather by careless picnickers who drop lighted matches and cigarette ends or do not completely extinguish picnic fires.

Dangerous fire hazards in industry include the presence of (a) explosives and compressed "permanent" liquefied and dissolved gases; (b) substances which ignite by the interaction or absorption of moisture and/or air; (c) substances with a flash point below 150° F.; (d) oxidising agents and substances liable to spontaneous combustion and readily combustible solids, such as wood sawdust and shavings, paper, loose fabrics, fibres, and similar materials, and certain finely powdered materials; as well as processes involving the application of

heat, especially with combustible materials, *e.g.* in drying rooms, nitrate salt baths, etc.; the production of inflammable waste or dust; processes associated with spray painting with inflammable or explosive liquids, and the use of inflammable solvents. Managements should adopt all possible precautionary measures to prevent fire, and provide appliances for quelling any outbreak at once. Fire precautions in some factories, such as those manufacturing explosives or celluloid, and those engaged in refining inflammable oils, are prescribed by statutory regulations.

Regulation of fire prevention in Great Britain is, with one or two exceptions, delegated to local authorities, which, either by special acts of parliament or by local by-laws framed under the Local Government Acts, insist on certain precautions being taken against fire in the construction of buildings, *e.g.* as regards construction of flues and hearths. The occupier of premises in which a fire is lit is bound to secure that it does not spread, and is legally liable for the damage if it does. Where a fire starts accidentally, he is not liable unless he has been negligent. The London Building Acts contain provisions designed to give protection against fire. Without the consent of the L.C.C. buildings must not exceed a certain height; warehouses and buildings used for trade or manufacture, if exceeding 250,000 cu. ft., must be divided by walls into divisions not exceeding 250,000 cu. ft.

Fireproofing. Misnomer popularly applied to methods designed to render materials or structures fire-resistant. Few materials and no buildings can sustain the application of intense heat for any length of time without suffering some damage. If the fire is hot enough, even steel will melt, and brick and concrete will fuse; there have been fires so hot that the materials of construction have actually flowed.

No method has yet succeeded in rendering any material incombustible; so-called fireproofing merely makes it less inflammable than it was. By means of chemical treatment it is possible so to alter the structure of certain materials that, in the event of their catching fire, they will smoulder or burn away slowly without bursting into flame. Materials thus treated are fire-resistant, as, if flame can be avoided, the risk of a fire spreading is reduced.

Wood may be made fire-resistant by impregnating it with sulphate of zinc and silicate of soda and tungstate. In order that the solution may penetrate the pores of the wood, the air is exhausted from the timber by keeping it under a vacuum for some time before the solution is introduced. In addition to solutions intended to penetrate wood, fire-resistant paints are used for superficial coating. Most of these paints have an asbestos basis, but while imparting a certain fire-resistant property, they are liable to peel off. Two or three applications of lime-wash will also render timber non-inflammable.

Fire-resistant Chemicals

Other agents used to render materials less inflammable include common salt, alum, sulphate of ammonia, sulphate of soda, sal ammoniac, borax, sulphate of lime, lime water, ammonium phosphate, ferric sulphate, aluminium hydroxide, and aluminium sulphate. These substances are applied by soaking the material in them in salt solution, and act by depositing minute crystals in the pores of the material. Closing up the pores with a non-inflammable substance denies access of air, so that in the event of fire the material merely chars superficially and does not burst into flame. Aluminium phosphate leaves an earthy deposit, when heated, which covers the material and resists the action of flames, while ammonium phosphate coats the material with a glossy protective covering of phosphoric acid. With most of these substances, it is necessary periodically to renew their application to the material, particularly in the case of fabrics such as are used for theatre curtains, as the crystals are only held mechanically in the pores of the material and repeated movement, gradually shakes them out.

Rendering a building or other structure fire-resistant is a matter of design and selection of materials rather than of so-called fireproofing. The materials which naturally offer most resistance to the action of fire are brickwork, firebrick, terra-cotta, plaster, iron, and steel. Next to good brickwork, reinforced concrete is the best fire-resisting material; it is very strong and takes up less space than brick.

To be classed as fire-resistant, a building should have a steel frame with several inches of concrete or tile covering every single piece of steel, particularly the

beams and columns. No built-in wood of any kind should be used; windows, doors, mouldings, skirtings should all be of metal or other non-inflammable material.

Each storey of the building should be, in effect, separated from those above and below by fire-resistant floors, while each storey should be subdivided by means of fire-resistant doors. It should be possible to close securely all exits from rooms in order to confine the fire, and to seal lift shafts and stairway wells with fire-resisting traps on each floor.

Fire-resisting floors are of various types. Filler-joist floors consist of rolled-steel girders supporting small section "filler" joists, with the panels between the joists and all the steelwork filled in and covered with concrete. Hollow tile floors are made up of clay or terra-cotta tiles or blocks laid in concrete and reinforced with steel rod. Concrete floors are built up concrete laid on steel mesh.

Automatically closing doors are used to isolate any part of a floor on which fire may break out. The doors are usually hung on an overhead track set at a rake so that the door tends to close itself. When open, the door is held by a cord or chain, fixed to the wall by a fusible link, passing over a pulley on the end of the track and carrying a counter-balance weight. In the event of a fire, the heat melts the fusible link, and the weight drops, closing the door. The doors are usually made of two steel plates $\frac{1}{4}$ in. thick having a core of asbestos. Thermostatically controlled roller doors or shutters are sometimes used in place of sliding doors.

To reduce the risk of window breakage in event of fire, which induces draughts that will fan the flames, fire-resistant glazing, i.e. glass at least $\frac{1}{4}$ in. thick reinforced by a wire mesh made from metal having a minimum melting point of 1,800° F., is used.

Fire Raising. Term used in Scots law for the act of wilfully setting on fire the property of another. The English equivalent is arson (*q.v.*).

Fire Service. Body charged with the duty of extinguishing conflagrations. In 1189 the ward-motes of the City of London ordered "all persons who dwell in great houses within the ward to have a ladder or two ready to succour their neighbours in case of fire, and to have in the summer time a barrel full of water for quenching fires." Under Edward I

watchmen were appointed who between sunset and sunrise were to give alarm in case of fire, and some attempt was made to provide organized cooperation, e.g. the city of Worcester in 1467 ordered "bucket carriers to be ready with their horses and buckets to bring water to every citizen when a fire occurred in the city." Failure to do so entailed a fine of forty pence. In 1583 the City of London ordered houses to be pulled down with engines, hooks, and ladders to prevent the spread of fire. (Houses in those days were built of wood.)

By 1774 every fire insurance company maintained its own fire brigade and fire engine, manned by volunteers, who were paid for attending fires on property insured by the particular company. In order that such property could be easily recognized, the company affixed its plate to insured buildings. The London Fire Engine Establishment was formed in 1833. It was supported by the insurance company brigades, an arrangement that continued until 1865, when the Metropolitan Board of Works established the Metropolitan Fire Brigade, under the command of Sir Eyre Massey Shaw. The equipment in 1866 consisted of seven large and 14 small steam fire engines, 64 manual fire engines, and two floating fire engines. In 1889 the Met. Board of Works was superseded by the London County Council, but the brigade changed its name to the London Fire Brigade only in 1904.

The city of New York, U.S.A., had a fire brigade by 1835, since it is recorded that on Dec. 6 of that year "a destructive fire occurred when 600 buildings were entirely destroyed as the firemen were powerless on account of the almost instantaneous freezing of the water in the engines."

Some of the larger cities of the U.K., including Manchester, Liverpool, Salford, Glasgow, and Belfast, were granted special powers by the government between 1845 and 1865 to establish fire brigades.

During 1866 to 1938, various enactments gave local authorities in Great Britain power to establish fire brigades, but did not compel them to do so, and it was usual for the authorities to supply engines and appliances from the rates, but to leave it to volunteers to man them. The Fire Brigades Act of 1938 made it compulsory for all borough, urban, and rural councils to provide both fire appliances and personnel, the costs being borne by the ratepayers,

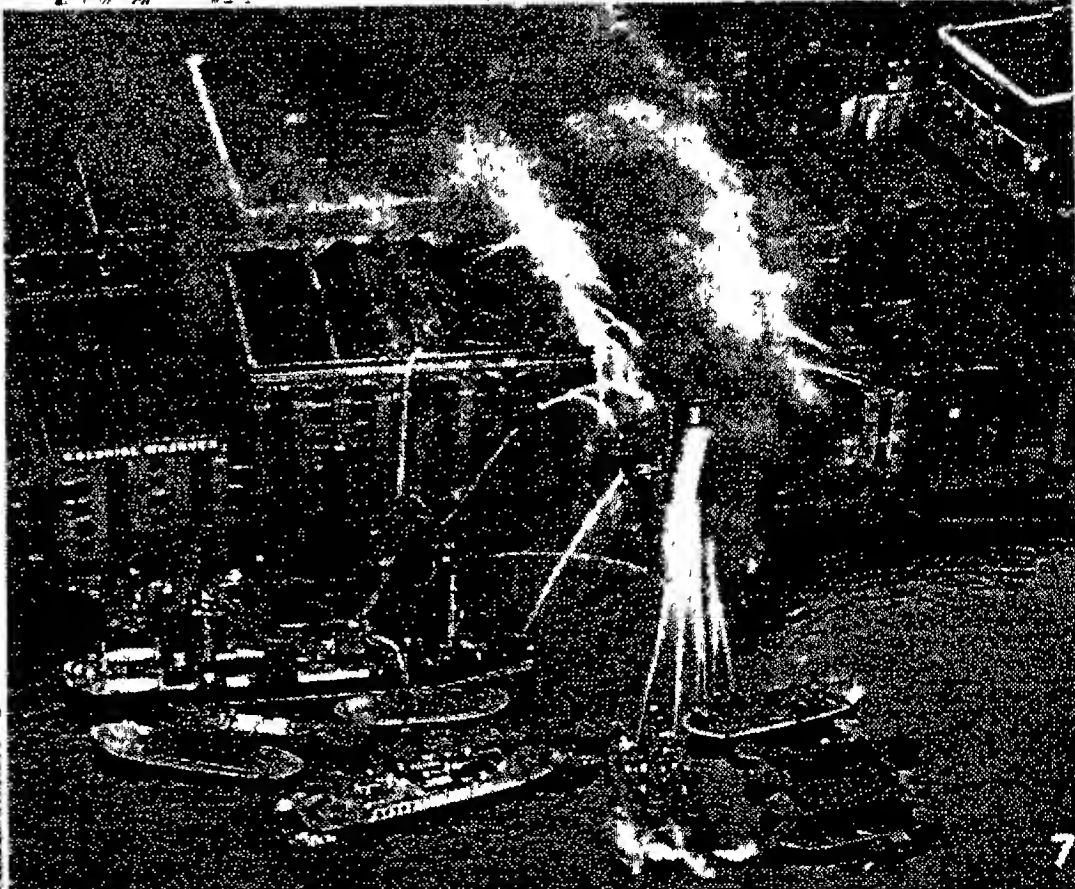
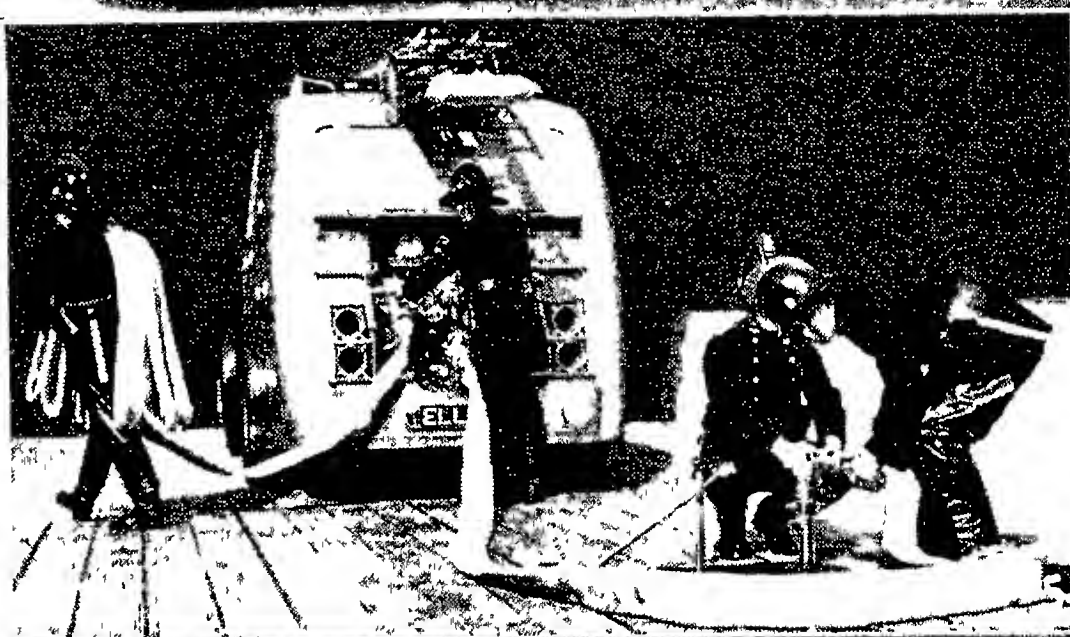
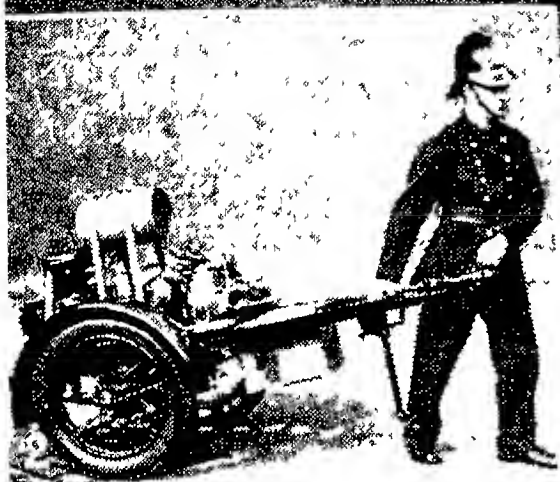
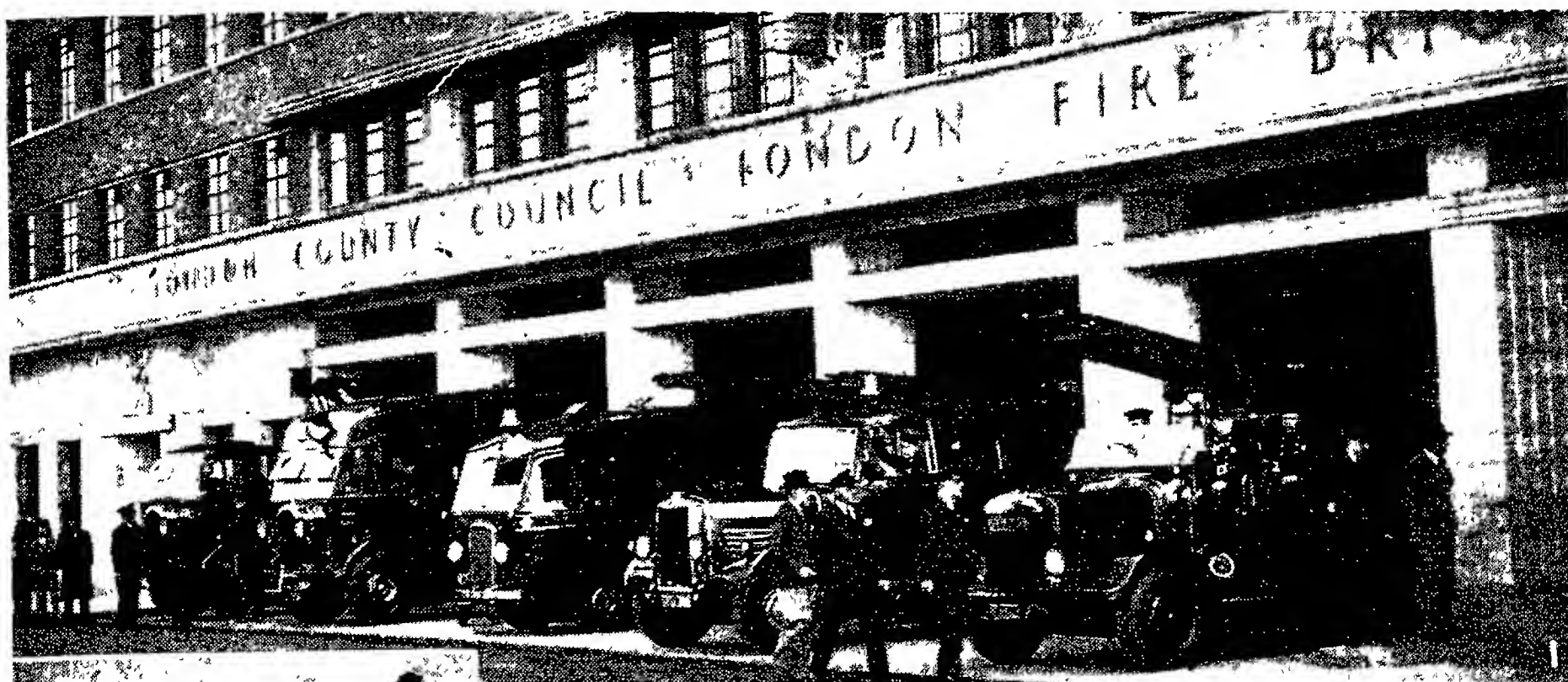
and to maintain them at a prescribed standard of efficiency.

In 1939 the fire brigades were included in the civil defence forces, and expanded both as to personnel and appliances at the cost of the government. Volunteers, forming the Auxiliary Fire Service, were trained by members of the regular fire brigades. Great Britain and Northern Ireland were divided into areas, and the fire brigades were grouped into districts each with a central control so that they could be mobilised quickly for service wherever needed. During 1940 and 1941, enemy air attacks on cities and towns grew so heavy that there was a grave possibility of breakdown in the fire services; and in May, 1941, the Fire Services (Emergency Provisions) Act was passed. This transferred the control of the fire brigades from local authorities to a central administration, the minister for Civil Defence becoming responsible for the reorganization of the fire brigades into the National Fire Service. This was divided into regions for administrative purposes, and each region was subdivided into fire force areas under fire force commanders. The government bore the cost, except that each borough, urban, and rural council had to contribute annually to the Exchequer 75 p.c. of its pre-war expenditure on its fire brigade. The strength of the N.F.S. in 1942 was approximately 100,000 men and women; 700 were killed in action, and about 7,000 were injured during the war.

The National Fire Service was dissolved by an Act of 1947. Instead of allowing the 1,668 local authorities of the 1938 Act to resume control, however, the Act of 1947 set up 141 local fire authorities under county councils and county boroughs, with four county councils and six district schemes in Scotland. Some central control and direction was retained, and part of the costs of complying with the standard laid down was borne by the Exchequer.

Fireship. Wooden vessel filled with combustibles that used to be set on fire and made to drift down upon an enemy fleet when it was at anchor or in harbour. The fireships were sent in thus to create panic or set on fire enemy vessels as they came in contact with them. The coming of steel and steam made the fireship obsolete.

A notable instance of the use of fireships was the attack made by means of them on the French fleet in the Basque Roads, on April 11,



1. Headquarters of the London Fire Brigade at Lambeth. 2. Light trailer pump. 3. Fire engine, equipped with turntable ladder. 4. Firemen on extended turntable ladders, dealing with a burning

London store. 5. Fire engine fitted with Diesel compressed-ignition motor pump. 6. Thames fire float, with monitor or water gun mounted amidships, and here at practice. 7. Firefloats at a wharfside blaze.

FIRE SERVICE: EQUIPMENT AND ACTIVITIES OF LONDON'S FIREFIGHTERS

1809. At Lord Cochrane's suggestion eight fireships and three explosion vessels, containing 1,400 barrels of powder with 400 shells and thousands of hand-grenades, were sent against the French on a dark night. So great was the panic caused by the explosion of these vessels that most of the French crews cut the cables and allowed their ships to drift ashore. An earlier use of fireships was against the Spanish Armada.

Fire Step. Term in military engineering. It is the raised portion of a trench on which a rifleman stands to fire over the parapet or through the sandbagged loopholes.

Fire Tactics. Term used for arrangements made to bring hostile troops under effective fire, whether from small arms or artillery. Fire tactics included both the dispositions made of the troops who brought fire to bear and the control by which the fire was directed. Some troops were if possible placed in a position to bring enfilade fire to bear on the enemy, while indirect fire, brought to bear from a position invisible to the enemy, was usually demoralising. Surprise effect was frequently obtained in defence by the withholding of fire by some units until a definite stage had been reached by the attack, and in attack by working some units round to a position in which the enemy did not expect them.

Another form of fire tactics was to site machine-guns in concealed positions covering an area over which an attack was expected; fire was held until the attacking troops had passed, when fire was opened on their rear.

In covering fire used during the Second Great War to enable unsupported infantry to assault an enemy position one Bren gun section compelled the enemy to keep under cover by spraying his position with automatic fire while the riflemen and a second Bren section advanced. The latter section then opened fire while the first advanced. Where no automatic weapons were available, the infantry advanced in waves, one wave giving covering rifle fire while the other advanced.

Fire tactics were also applied to artillery. Thus barrage (*q.v.*) fire saturated the enemy defences, compelling him to keep under cover and cutting his communications with the rear while the infantry advanced to the assault. In counter battery work, the artillery on one side maintained steady fire on the enemy artillery



Fire-Walking. Indian practitioners of the rite, marching over glowing charcoal

and so prevented him from supporting his own infantry. See Artillery; Fire Control; Tactics.

Fire-Walking. Magical rite practised by several primitive peoples, mainly to ensure sunshine and bountiful crops. The celebrants walk barefoot over heated stones or embers, and are reputed to emerge unscathed. S. P. Langley, witnessing a ceremony at Tahiti in 1901, found that the volcanic rock used was a bad conductor, the upper surface being only moderately warmed. W. L. Allardyce, watching it in Fiji in 1904, reported that a handkerchief was charred by the stones, and

that a thermometer registered an air temperature over the pit of 280° F. Other modern accounts come from Mauritius, New Zealand, Japan, China, India, and Bulgaria. The rite sometimes consists in passing through flame, especially as an act of devotion, a custom preserved among European rustics when leaping over bonfires "for luck."

Fire-walking as a chastity or sanctity ordeal was recorded in early Vedic India (c. 1200 B.C.), passed into medieval Europe, and in the form of treading barefoot over nine glowing ploughshares was successfully accomplished by Queen Emma, mother of Edward the Confessor. See Ordeal.

Firewatcher. Member of a section of the A.R.P. organization during the Second Great War. By a ministry of Home Security order of Sept. 22, 1940, a firewatcher had to be on duty at all times on all premises in which more than 30 persons were employed. The duty of the firewatcher was to deal with any outbreak of fire at the earliest possible moment with the means at his disposal, and also to inform the fire service. Firewatching was suspended March 24, 1945. See Fire Guard.

Fire-Water. Generic, popular name for any spirituous or distilled liquor, originally used by the natives of half-civilized lands for European cordials. It is akin to the Spanish name for brandy, *aguardiente*, or "burning water," to the Celtic *usquebaugh* and the French *eau-de-vie* or "water of life." See Brandy.

FIREWORKS: FOR DISPLAY AND WAR

Alan St. R. Brock. Author of *A History of Fireworks*

This article, which traces the development of fireworks and explains their composition, is supplemented by shorter ones on the various particular forms of firework, e.g. Rocket; Roman Candle; Squib. See also Flare; Gunpowder

The art of firework making, or pyrotechny, is of great antiquity and seems to have originated in central Asia, although its subsequent development there has not kept pace with that in the W. A firework may be defined as a case, generally of rolled paper and cylindrical, containing a combination of ingredients capable of burning independently of atmospheric oxygen. To achieve this result one component must possess a supply of oxygen which it gives up readily to the other, or others, during combustion. The first chemical compound used for this purpose was saltpetre (potassium nitrate), which is found in surface deposits throughout Asia; and

the earliest experiments in firework making were probably the result of observing the effect when some saltpetre happened to fall among the ashes of a wood fire, causing the embers to splutter and glow. In course of time, another readily burning ingredient, sulphur, was added, and so the components of gunpowder were brought together. It was not, however, until the 12th century, when the German monk, Berthold Schwartz, invented the principle of the gun, that the most suitable firework composition came to be known as gunpowder.

Firework mixtures seem to have been introduced into Europe by returning crusaders and first

developed in Italy. In 1540, Vanuzzio Biringuccio, of Vienna, produced *De la Pirotechnia*, the first serious work on the subject. By the middle of the 16th century, firework displays of a primitive kind became fairly frequent on the Continent. Stowe records that Henry VIII brought over two Dutchmen, who made hollow shot of cast iron "stuffed with firework or wyld fire," but not until the reign of Elizabeth was anything in the nature of a set display given in Great Britain. In 1572 the Earl of Warwick entertained the queen with a display of fireworks in the Temple Fields. Others given in her honour were at Kenilworth two years later, where "there were fireworks showed upon the water which were both strange and well executed," and at Elvetham, by the Earl of Hertford in 1591.

During the 17th and 18th centuries many displays were given in celebration of coronations, royal weddings, births, peace, etc. The somewhat limited variety of effects it was then possible to produce was supplemented by elaborate scenic structures in the form of classic colonnades and temples, illuminated from within to show transparent pictures. An outstanding example was the "Temple or Machine" erected in Green Park, London, to celebrate the peace of Aix-la-Chapelle, 1749. Over four hundred ft. in length, it was adorned with "frets, gilding, lustres, artificial flowers, inscriptions, statues and allegorical pictures, etc." Fireworks provided one of the principal attractions of such pleasure gardens as Marylebone, Vauxhall, and Ranelagh, which sprang up during the 18th century. At these, more or less elaborate scenic settings provided backgrounds for the pyrotechnic displays. At the end of the century the employment of potassium chlorate enabled colours to be introduced, and, with the increasing variety of effects it was possible to produce, the use of scenic aids gradually declined.

The displays carried out by Brock at the Crystal Palace from 1865 to 1910 and from 1919 until the destruction of the building by fire in 1936 were, perhaps, the most important factor of the development of the art. The peace displays, in Hyde Park, July, 1919, and on the Thames, June, 1946, were highly elaborate and extensive.

COMPOSITION AND CONSTRUCTION. Firework compositions always contain an oxygen-supplying

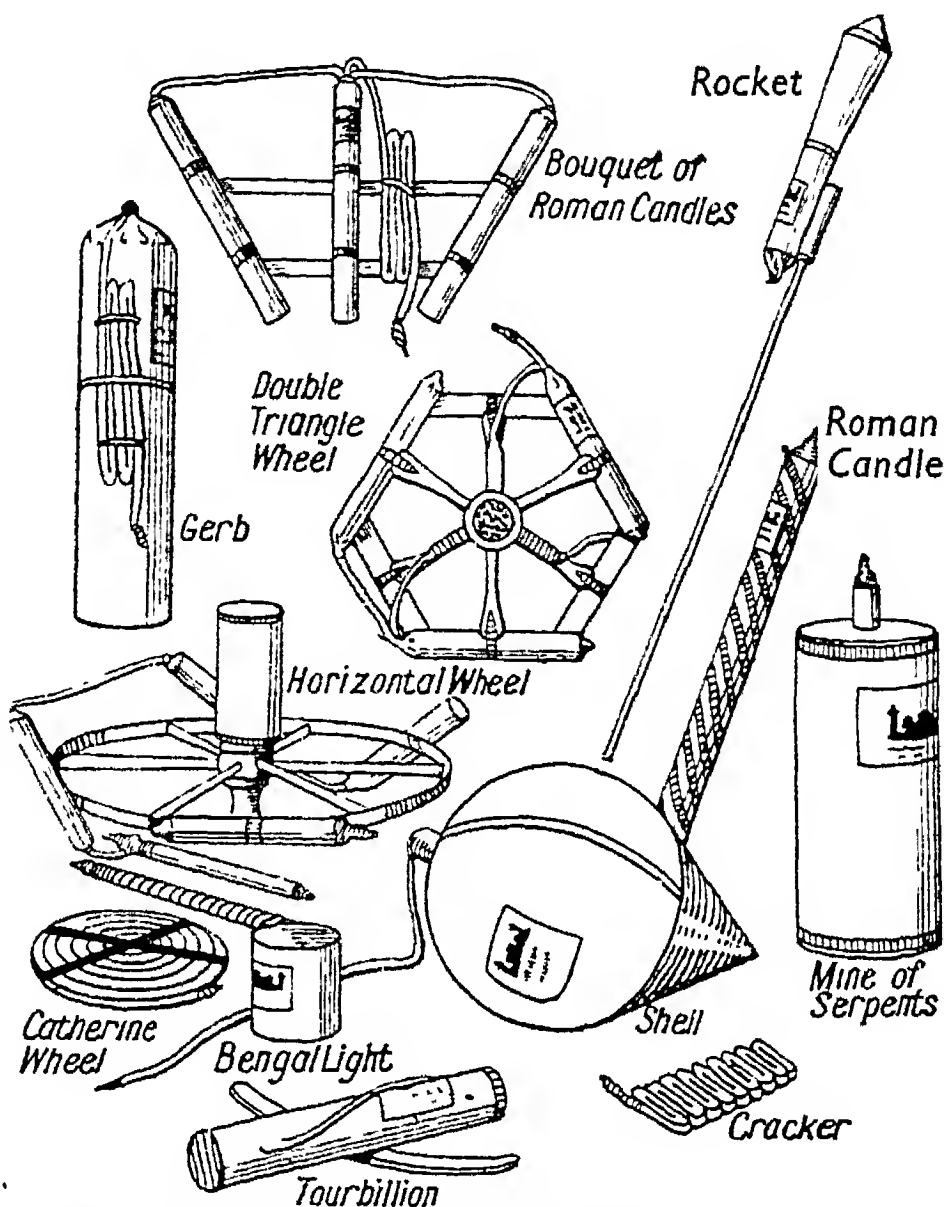
chemical, such as the nitrate or chlorate of potassium, together with burnable substances such as sulphur, and charcoal and carbon compounds such as resins, gums, starch, etc. To these are often added metals either in a pure state finely divided or as salts. Iron and steel filings are introduced to produce sparks and coruscations; powdered magnesium and aluminium give dazzling brilliant flame

candles and rockets. When extra force is required, the case is "choked," either by a diaphragm of clay with a central hole of the requisite size or by constriction before the case is dried.

Tourbillions and Saxons have the ends of the case closed with clay and a horizontal hole bored near either end so that the fire issues at right angles to the axis. The holes in the Tourbillion rotate

the case on a piece of curved wood secured to its centre, and secondary holes pointing downwards project it into the air. The Saxon, or Chinese flyer, revolves on a nail, fixed horizontally, driven through the centre of the case.

Compound fireworks are composed of a number of the foregoing, fixed to wooden frameworks in the form of wheels or geometrical patterns. In the revolving pieces the motive power is supplied by gerbs or turning cases, which are in effect small rockets without heads. The best known pieces are rain-



Fireworks. Various types of fireworks in popular use for displays and illuminations

either with or without sparks. Metal salts, in conjunction with potassium chlorate, produce coloured fires: those of strontium produce red, of sodium yellow, of barium green, and of copper blue.

The usual method of construction is to charge a case of strong paper rolled on a former with the composition. The lower end of the case is closed by constriction or, where necessary, by a diaphragm of compressed clay. The lighting end is "primed" with an easily ignited and hotly burning composition, its function being to start the combustion of the contents of the case. Some types of firework are so designed that the case burns down with the composition; these include coloured lights, starlights, and the small "lances" used to outline designs and set pieces. With others the case remains unburned, and the fire is projected with greater force from the mouth of the case. To this type belong fountains, roman

bow, single and double triangle or caprice wheels, revolving fountains, Saxon cross, chromatrope, and tree piece. The fireworks are connected on the framework with quickmatch—cotton wick soaked in a paste of starch and gunpowder, dried, and threaded in a paper tube. Lancework pieces are carried out with small coloured fireworks or lances spaced at short intervals following the lines of a design or picture and connected by quickmatch. The real development of lancework, which had hitherto been used merely to outline spokes and scrolls on wheels and for similar purposes, dates from 1875, when portraits and other pictorial effects were introduced in the displays at the Crystal Palace.

Aerial fireworks, such as rockets and shells, are those which produce their effects in the air. Shells are hollow spheres of papier maché filled with stars, or other pyrotechnic effects, and bursting



charge. They are fired from a mortar by means of a lifting charge of gun-power in a conical bag fastened to the lower side of the shell. The quickmatch which lights the lifting charge also ignites a time fuse at the top of the shell, which again ignites the bursting charge and contained effects upon reaching its maximum height.

In addition to their spectacular entertainment value, the uses of fireworks include life saving and communication at sea, by means of line-carrying rockets; distress signals and flares; the destruction of vermin by poisonous smoke emitted by fireworks made for the purpose; "bird scarers" designed to explode at regular intervals; and starters for Diesel engines. In war pyrotechnic signals provide means of recognition and communication, both on land and sea. Rockets emitting coloured stars, Very lights (a development of the roman candle designed to be fired from the barrel of a specially constructed pistol), and bombs discharged from mortars are used. Illuminating flares suspended from parachutes were employed during the Second Great War by the Royal Air Force on night operations. A distress signal, burning with a brilliant red flame and throwing up a succession of red stars, saved the lives of many airmen who had taken to their dinghies after coming down in the sea. Firework mixtures, burned in metal canisters, were also employed to lay smoke screens to conceal troop movements from enemy observation.

Fire-Worship. The ritual expression of reverence for fire as a natural element affecting human welfare. It is traceable in Dahomé, among the Ainu, some Mongols, and American Indian tribes. In ancient

Mexico, Xiuhtecutli was revered with daily offerings and periodic rekindlings before his image. The cult prevailed in early Aryan India, whose fire-god Agni, personifying earth-kindled fire, lightning, and solar heat, was reborn daily of ten maidens, the fingers which twirled the sacred fire-drill. Honoured by 200 Vedic hymns, his ritual still survives here and there.



Fire-Worship in ancient Nineveh. Fire-altar and sacrifice from a bas-relief at Kouyunjik, Assyria. Upper picture, fire-altar from Khorsabad, Assyria

In early Persia a less developed fire-worship appears in the Avesta, wherein Atar, a son of Ahura-mazda, shares his conflict with darkness and impurity. In the Mazdean ritual, sacred fire, preserved in fire-temples, is not an object of worship but an emblem of divine power. This view is maintained by its modern exponents, the Persian Gabars and the Indian Parsees. At Baku, on the Caspian Sea, 18th century pilgrims gathered for expiation before stone temples near the burning oil wells. Many phases of culture exhibit fire-rituals loosely classed as fire-worship. The perpetual fires of the Greek *prytaneum* and the Roman *regia* with its vestal virgins were forms of Aryan hearth-ritual. These rites survive to some slight extent, with much primitive superstition, among the peasantry of E. Europe. The Semitic use of perpetual fire-altars for burnt offerings, passed into the ceremonial lights of ritual Christianity. See Moloch; Sun-worship; Zoroastrianism.

Firing Party. Squad of soldiers, sailors, or airmen, who fire volleys from small arms at intervals for some special purpose, such as a military execution, or as a

salute at a military funeral. At funerals the firing party marches with the cortège with reversed arms.

Firing Pin. Pin that strikes the cap of a cartridge in a rifle or other firearm using cartridge ammunition. In a rifle the firing pin passes through the bolt, and when the bolt is pulled to the rear the firing pin compresses a spring and is held by a sear which engages with a bent. When the bolt is pushed forward to ram the charge into the breech, the firing pin remains to the rear, and is in the cocked position. Upon the trigger being pressed, the sear is disengaged from the firing pin and flies forward to strike the cartridge cap and so fire the round. A similar principle actuates the firing pin of automatic small-arms and machine-guns, except that the bolt is operated by the discharge of the rounds. In the Sten machine carbine the firing pin is fixed to the face of the bolt and has no independent action.

Firkin. Old English ale measure, the fourth of a barrel, or 9 galls. Originally it varied from $7\frac{1}{2}$ to 8 galls., and now it would equal $9\frac{1}{4}$ imperial galls. As a small wooden cask to hold butter, a firkin contains 56 lb. The word is derived from Dutch *vierde*, fourth, and a diminutive suffix-kin.

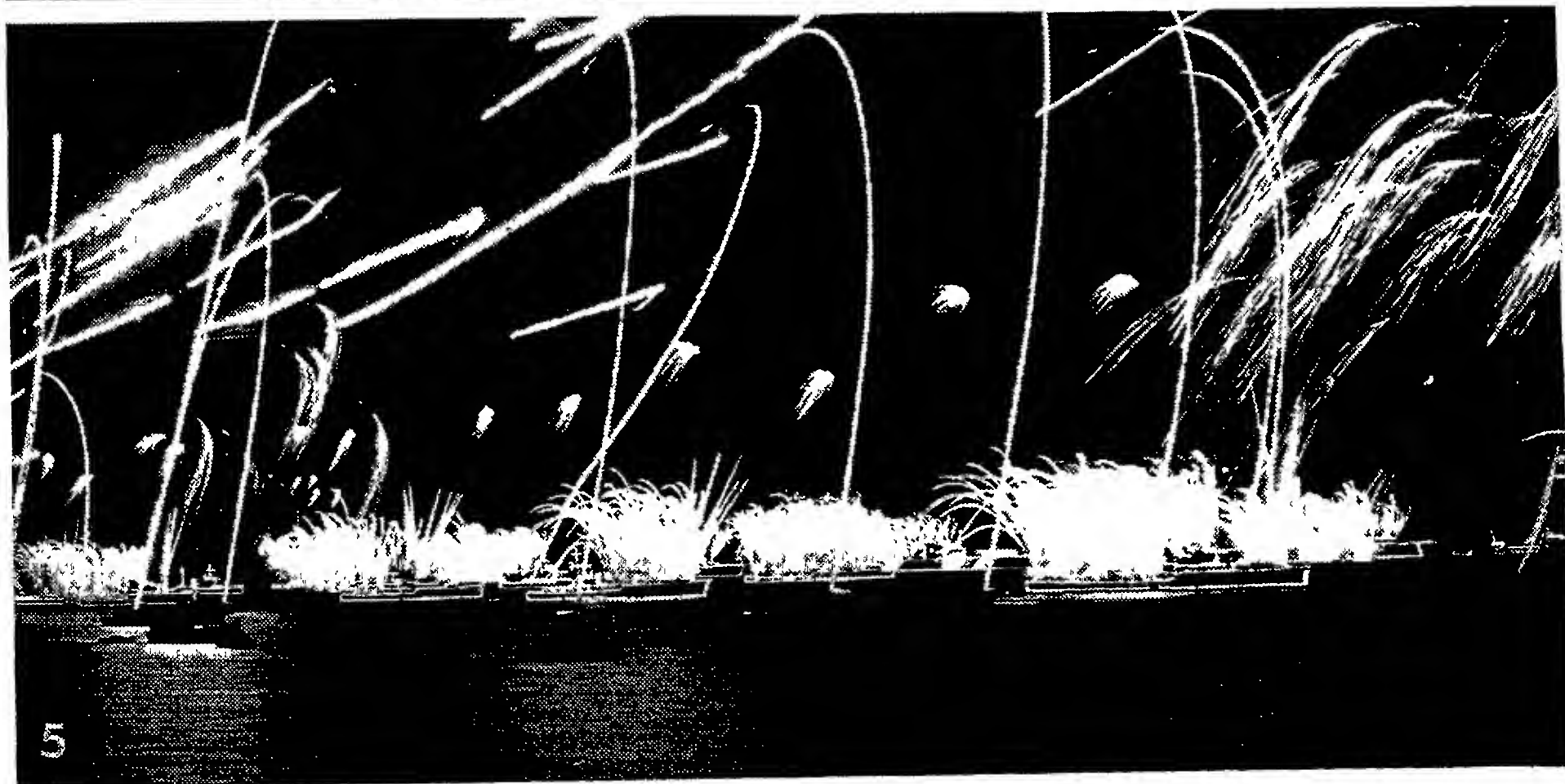
Firle Beacon. Eminence in Sussex, England, 3 m. S.E. of Lewes. It rises 718 ft. above sea level and gives views of the English Channel from Newhaven to Seaford, the Weald, and into Kent.



Firle Beacon, Sussex. On the summit is a tumulus broken down by the generations of fires lighted on it

Firlot (Four lot). An obsolete Scottish measure of dry capacity, being the fourth part of a boll. It varied for wheat and barley, and in different localities.

Firm (Span. *firma*, signature). Word used for an association of business men. In commercial circles of the 17th century and thereabouts it was used for a business signature one that



1. Fireworks rising above the Alexander III bridge over the Seine during a Paris fête. 2. Part of a display over Monaco Bay in celebration of the marriage of Prince Rainier III of Monaco and Grace Kelly, April 19, 1956. 3. A burst of brilliance lights up the sky over Valletta,

Malta, on the occasion of the visit in 1954 of Queen Elizabeth II with the Duke of Edinburgh and their children. 4. Climax to Bastille day celebrations in Paris, 1957. 5. Fireworks at Portsmouth in honour of the coronation review of the Fleet by Queen Elizabeth II, 1953

FIREWORKS: BRILLIANT LIGHT PATTERNS IN THE NIGHT SKY.

clinched a deal, and was then applied to the business house that signed. It became the legal term for members of a partnership. *See Business Names.*

Firmament (Lat. *firmare*, to make firm). Term used for the vault of the heavens. It is used to translate the Hebrew word *rakia* (Gen. 1, v. 6), which originally meant anything extended or stretched out, and then refers to the universe.

Firminy. Town of France. It is in the dept. of Loire, 8 m. S.W. of St. Étienne, and is situated in a coalmining district. Other industries are steel and iron manufacture, and the making of woollens, buttons, and ribbons. Pop. (1954) 21,161.

First Aid. Term for assistance given in accident or sudden illness before medical advice can be obtained. A knowledge of the principles of first aid has been promulgated widely in Great Britain by the three major training bodies—the St. John ambulance association, the British Red Cross, and the St. Andrew's ambulance association—and by local education authorities. During the two Great Wars, persons possessing first aid qualifications from any of these associations proved of great value in augmenting the strength of the medical corps of the armed forces and, in the Second, of the civil defence organization.

HAEMORRHAGE AND WOUNDS. Bleeding, unless very slight, demands priority of attention in any accident. It may be stopped by firm and continuous pressure on the bleeding point. If this fails to control the bleeding, clean dressings or clean handkerchiefs should be bandaged firmly on to the wound. If there is a blood clot in the wound it should not be disturbed; but any loose foreign body should be removed.

Minor scratches and grazes should be thoroughly cleaned with boiled water, a mild antiseptic (if available) should be applied, and the wound should be dressed with clean lint. In more serious wounds which require medical attention, cleansing and application of antiseptic should be omitted by the first aider if much pain is caused.

ASPHYXIA. Asphyxia also demands urgent and skilled action by the first aider. The immediate and sustained application of artificial respiration (*q.v.*) in fresh air is necessary. Asphyxiation is most commonly due either to coal gas poisoning or to drowning, but electric shock or motor-car exhaust fumes are other possible causes.

The patient becomes unconscious and breathing is absent or almost so. Even if the patient appears to be dead, artificial respiration must be applied continuously until medical advice can be obtained.

FRACTURES. Only if there is continuing danger should the patient be moved before skilled treatment is available. First aid treatment should be directed towards the immobilisation of the broken bone.

In fractures of the upper limb, the arm should be placed beside the chest, the elbow bent (if possible) and the forearm placed across the chest with the fingers pointing to the opposite shoulder. The arm is bandaged to the chest in this position.

In fractures of the lower limb, the injured limb should be gently pulled into line with the sound one, the feet bandaged together and a number of bandages applied round both thighs and both lower legs, but avoiding the actual point of the fracture. Padding between the knees and ankles is also necessary.

Unskilled attention for a fracture of the spine can be dangerous. If this injury is suspected, the patient should not be moved in any way until skilled help is available. Gentleness in handling and support of the site of fracture to prevent the broken bone ends from moving are basic essentials in the treatment of fractures.

SPRAINS. A firm bandage should be applied and kept wet with cold water. If the ankle is sprained out of doors, the boot or shoe should not be removed until the patient returns to his house. Whenever it is doubtful whether the person has sustained a sprain or a fracture the injury should be treated on the assumption that it is a fracture.

BURNS AND SCALDS. First aid treatment is directed towards preventing germs from reaching the burned areas. This is done by covering the burned parts as soon as possible with clean dressings. No oil or ointment should be applied; blisters should not be opened. Burned clothing should not be purposefully removed, nor need unburned clothing be cut off unless this can be done without discomfort and without touching the burned area with the undamaged clothing.

All fires should be properly guarded, for many severe burns are due to the clothing's catching alight from an unguarded fire. In this situation the patient should be closely wrapped in a carpet, blanket, or heavy coat to smother the

flames—any thick, pliable material will serve.

Occasionally burns are caused by strong chemical fluids. Here the first steps should be to remove at once any clothing moistened by the chemical and to wash thoroughly the affected parts of the body in running water. Clean, dry dressings should then be applied.

SHOCK. This may arise from any injury of moderate or greater severity. It is due to loss of blood, whether externally and visibly or internally and invisibly. Owing to the loss of circulating blood, all parts of the body are deprived of a full supply of oxygen which is carried in the blood. The action of the heart is impaired, and the pulse at the wrist is weak; breathing is shallow; the injured person feels weak. If shock begins to appear, the patient should be transported as rapidly as possible, yet with gentleness, to medical aid—preferably to a hospital. The patient should not be over-warmed nor over-cooled.

POISONING. A message should be sent immediately to the nearest doctor explaining the nature of the case and, if possible, giving the name of the suspected poison. The bottle or other vessel containing the suspected poison, together with any vomited material, should be kept until it has been examined. Assuming the patient to be conscious, treatment should be directed (1) to the elimination of the poison by the administration of an emetic, provided the poison swallowed was not a corrosive fluid, such as oil of vitriol, when the lips and mouth will probably be found to be burned; (2) towards reducing the action of the poison by giving plenty of water and demulcent drinks. An emetic readily obtainable is salt, one or two tablespoonfuls in a tumbler of warm water. Demulcent drinks are milk, milk beaten up with eggs, cream, any vegetable or animal oil.

LOSS OF CONSCIOUSNESS. There are many causes for a loss of consciousness. Unless the cause is known to be of slight importance from the medical point of view, *e.g.* a "faint," medical assistance should be sought at once. In the meantime all tight clothing should be loosened and an ample supply of fresh air assured. If asphyxia is the cause, artificial respiration must be applied at once; otherwise the patient should be placed on his side with the abdomen leaning over towards the floor. The arm and leg uppermost should be bent forwards to give a little support

for this position. If there is any tendency to vomit, the patient should be placed face downwards to permit the vomit to flow out of the mouth and thus reduce the risk of its inhalation.

No alcohol, or indeed any other liquid, should be given to an unconscious patient.

BITES AND STINGS. As a result of stringent regulations governing the import of animals, rabies is not now encountered in Great Britain. Bites from animals should therefore be treated in the same way as other wounds but, as wounds from bites are commonly infected with germs, medical advice should always be sought.

In stings caused by plants and insects, the sting should be removed if possible, the part bathed with weak ammonia, and then dressed with a paste of bicarbonate of soda with water.

FOREIGN BODIES. Those in the eye can as a rule readily be removed, if on the under surface of an eyelid, by the moistened corner of a handkerchief. But if the foreign body is on the ball of the eye, and not easily removed by gentle brushing, a pad of cotton-wool should be bandaged over the eyelid, in such a way that the light pressure of the cotton-wool prevents undue movements of the eyeball, until medical advice can be obtained.

Foreign bodies in the nose or ear should not be interfered with by the unskilled, and no attempt should be made to remove a needle unless it is projecting: the affected part should be kept at rest, and medical advice should be sought.

REMOVAL OF CLOTHING. Clothing should always be removed very carefully from an injured person. It should always be removed first from the sound limb; and it may be necessary to cut it away on the injured side. If so, the trousers or coat-sleeve should be cut up the outer, not the inner, seam. A boot or shoe is best removed by cutting the lace and then the back seam; it can then be easily lifted from the foot.

First Aid Nursing Yeomanry. Women's voluntary organization founded in 1900 as the Field Ambulance Nursing Yeomanry, for service with the British Army in the S. African War. In 1907 the organization was officially recognized by the War Office and



Badge of the
F.A.N.Y.

its title was changed. The F.A.N.Y. served throughout the First Great War, being one of the first women's organizations to go overseas, where it performed ambulance convoy work and nursing in France, Egypt, and Salonica. The corps subsequently trained as a mechanical transport unit.

In 1938 the Army Council invited its cooperation in the formation of the Auxiliary Territorial Service (*q.v.*). The unit now became the Women's Transport Service. It supplied all personnel for the first 10 driver companies of the A.T.S.; these members were called up in Sept., 1939, and went to France; and one company to Finland as ambulance drivers. The unit continued to recruit for motor companies of the A.T.S. until Sept. 1, 1941. The remainder of the corps continued as a self-supporting organization, with its own headquarters. Its personnel were employed as drivers (British Red Cross society); drivers and staff (Air ministry); drivers and canteen workers (Polish forces); telegraphists, coders, and secretaries (special forces); canteen and welfare workers (S.E.A.C. army welfare); and secretaries for the war cabinet, War office, and Foreign office. Some members were parachuted into enemy territory; two were awarded the George Cross for work with the resistance movement in France. The peace-time F.A.N.Y. club is at 55, Sloane St., London, S.W.1. Consult F.A.N.Y. Invicta, Irene Ward, 1955.

Firstborn. Technical term in the Jewish religion. In commemoration of the deliverance from Egypt, all firstborn human males were consecrated to God's service, *i.e.* to the priesthood, but every child that lived more than one month could be redeemed from that service. After the building of the tabernacle the tribe of Levi was appointed to the priesthood in supersession of the firstborn (Ex. 4, 13, 22, 34; Num. 3, 8, 18).

The firstlings of animals, if clean, were offered in sacrifice; if unclean, redeemed. For an ass a lamb had to be substituted, otherwise the neck of the ass had to be broken. The Jews, who are referred to as the firstborn among the nations, still solemnise the redemption of the firstborn on the 30th day after birth. In the N.T. the term firstborn is used in relation to Christ, the dead, and the Church (Col. 1; Heb. 12; Rev. 1).

First Division. English legal term. Until the system of divisions was abolished by the Criminal

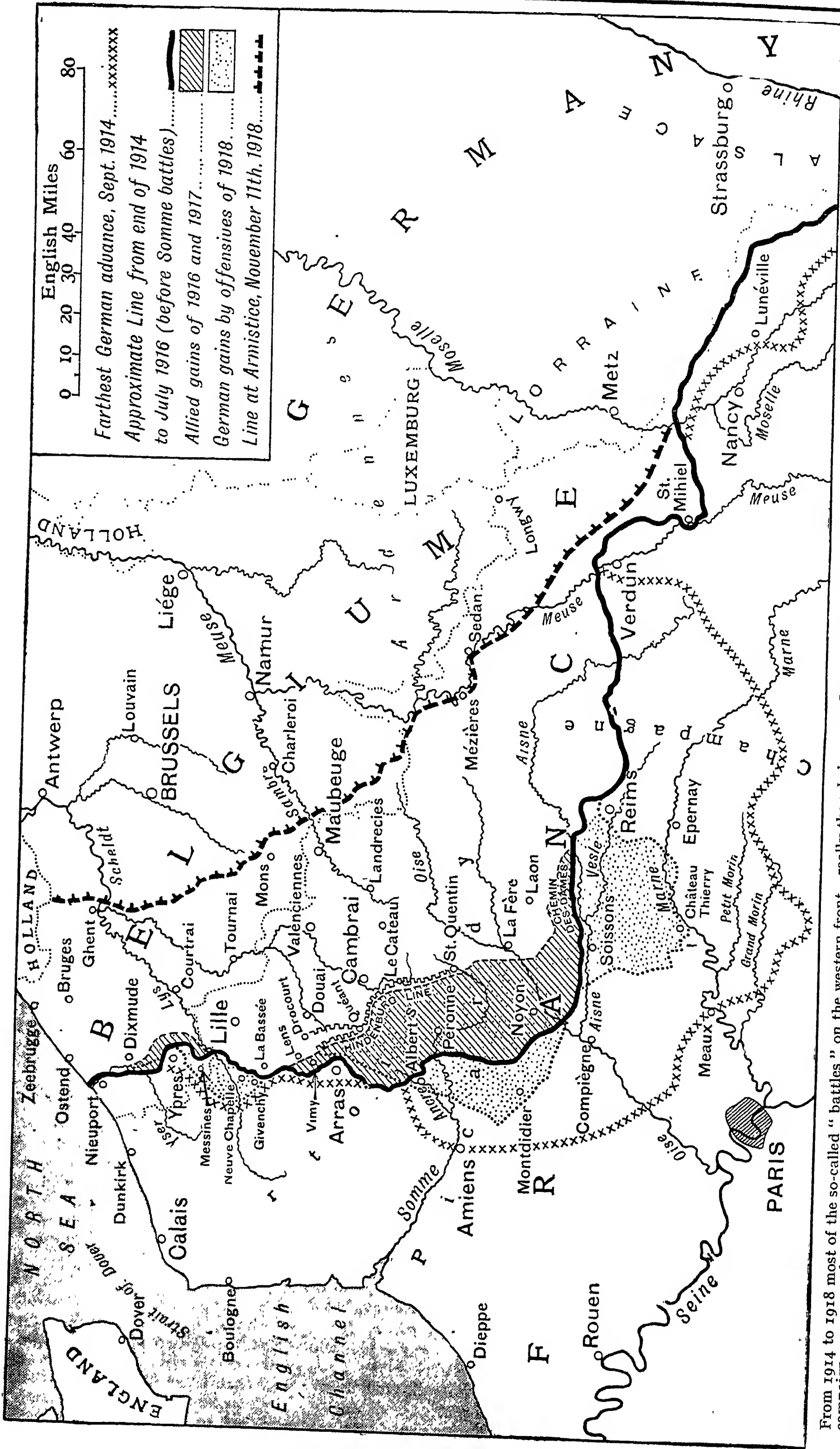
Justice Act, 1948, the court had power to indicate to some extent the nature of the imprisonment to which a convicted person should be subjected by sentencing him to imprisonment in the first, second, or third division. Even before that Act, the power was rarely exercised, for the view had come to be held that the exact nature of the treatment to be received by persons sent to prison should be determined by the prison commissioners and not by the courts.

Imprisonment in the first division was usually ordered for persons who could not be regarded as criminals in the ordinary sense of that word. They were not forced to work, although if they did they earned a remission of sentence. They were kept apart from prisoners of other classes and could wear their own clothes and use their own furniture. They could order food and drink from outside prison.

First Empire. Name given in France to the period from May 18, 1804, when Napoleon Bonaparte became emperor and the first republic came to an end, to April 14, 1814, when Napoleon I signed his first abdication.

First Footing. New Year's Day folk custom, especially in Scotland and the N. of England. As soon as midnight chimed people hurried to give their friends first footing, to offer them good wishes, and to partake of their hospitality. It was regarded as unlucky for a woman or a fair-haired man to be the first visitor to any house on New Year's Day; sometimes a dark man of the family would go out just before midnight to be the first to enter after it. The custom may be traced back to Druid times, when the priests sent their young men from house to house bearing branches of mistletoe.

First Fruits. Ancient religious practice of offering to God a portion of the first fruits of a crop or the first profits of any commercial undertaking. Prescribed by the law of Moses, among the Hebrews it was usually one-sixtieth, but might be as much as one-fortieth. In the early Christian Church the practice was continued, though it was regarded as a work of devotion and not of obligation. Later it was claimed by the clergy as their due and formed part of their official income. The Apostolic Constitutions (*q.v.*) direct that the first fruits of cattle and crops should go to the clergy, and that other first fruits should be devoted to the relief of widows and orphans. See Annates; Tithes.



From 1914 to 1918 most of the so-called "battles" on the western front—really the whole campaign was a prolonged battle—resulted in gains and losses of territory, entirely disproportionate to the loss of life involved, that appear insignificant on a large-scale map. Hence the operations can be simplified into five broad phases. First there was the German maximum advance. The battles of the Marne and the Aisne, followed by the

outflanking race northwards, converted this into that stabilised trench line from the sea to Switzerland which remained substantially unaltered for more than a year. Next, there were the Allied gains of 1916-17; next, the German advance in the spring of 1918; and, last, the Allied advance that ended with the Armistice. The place names and national boundaries shown on this map are those obtaining at the outbreak of the war in 1914.

FIRST GREAT WAR: MAP OF THE WESTERN FRONT FROM SEPT., 1914 TO NOV., 1918

THE FIRST GREAT WAR, 1914-1918

H. W. WILSON, joint editor of *The Great War*, and GORDON STOWELL

This is a general survey, designed for ready reference, of the main causes, events, and immediate results of the 1914-1918 world conflict, described throughout this work as the First Great War. More detailed information is given in many other articles, e.g. under the principal battles, Aisne, Marne, Somme, Tannenberg, Verdun, Ypres, Falkland Is., Jutland, etc.; under the histories of the various countries involved; and under such headings as Air Raids; Army, British; Casualty; Compulsory Military Service; Royal Air Force; Royal Navy; Sea Power; Strategy; Tank; War Memorials. See also articles on the various treaties—Brest-Litovsk, St. Germain-en-Laye, Versailles; and biographies of soldiers, sailors, and politicians

The First Great War was the first war in history in which great nations threw into the scale their total resources of man-power and material wealth, so that the struggle was waged and endured by whole populations rather than only by armies and navies. The opponents were the Central Powers on the one hand, with Germany and Austria as the leaders, and the Allied and Associated Powers on the other, led by France, Russia, Great Britain, and (later) the U.S.A. A list of the combatants is given under Alliance (*q.v.*).

The war began with the declaration of war by Austria upon Serbia, July 28, 1914; and fighting continued until 11 a.m. of Nov. 11, 1918, when it ceased in accordance with the terms of the armistice granted by the Allied c.-in.-c. to the defeated army of Germany, the last of the Central Powers left in the field.

Casualties and Cost

The greater part of the actual fighting was waged by land armies. At the outset the armies of the combatants were mobilised to a total of over 16,000,000 men. At the end of the war the total mobilised strength in service was nearly 26,000,000. From first to last the Germans mobilised 11,000,000; Great Britain and the British Empire, 8,904,000. Nearly 8 million combatants of all sides were killed.

The material cost of the war can be estimated only approximately. The cost to Great Britain was about £8,000 million; to Germany about the same; to France £5,000 million in addition to the enormous loss by devastation; to Italy £2,400 million; to the U.S.A. £4,200 million. As the immediate or indirect result of the war nearly £40,000,000,000 of expenditure or debt was incurred.

CAUSES OF THE WAR. The root causes were implicit in the course of European history during the preceding 50 years: *e.g.* in the rapid rise of the German empire, the development of a national desire for the ascendancy and dominance of the German race throughout the world, the economic

rivalry with and jealousy of longer-established empires entailed by this desire, and the necessity for an expanding Germany to widen her markets even at the expense of her rivals; in the resentment of France against the harsh treatment she had received after the Franco-Prussian war of 1870, and particularly against the loss of Alsace and Lorraine; in the suspicious antagonism of Russia towards the friendship of Germany for the declining Austro-Hungarian empire; in Austria's mistrust of Russian policy in the Balkans and in the Austrian fear of the aspirations of Serbia, especially after Serbia's victory in the Balkan war of 1912, and in view of her open support by Russia.

Antagonism in Europe

The effect of these tendencies was to reduce Europe to two mutually hostile armed camps, and the increase on all sides of preparations for war only exacerbated the irritation. Various episodes during the opening decade of the 20th century served to define the precarious situation more clearly. The convention of Algeçiras (*q.v.*), 1906, arising out of Germany's challenge to France over her interpretation of the Anglo-French treaty regarding Morocco, found Great Britain strongly supporting France, and led immediately to military conversations between the two countries. In 1908 the sudden annexation by Austria of Bosnia and Herzegovina (mainly because of a fear of the revival of Turkish power in the Balkans after the Young Turks revolution) was distasteful to Russia, and was not recognized by Serbia. The Agadir (*q.v.*) crisis of 1911, following the French occupation of Fez, almost marked a breaking-point, but Germany was not yet ready to counter the additional weight of Great Britain as a potential enemy. The swift increase of the German navy in the year that followed, together with such preparations as the widening of the Kiel canal to admit the passage of modern battleships, were directly aimed at neutralising this additional weight, though these activi-

ties were matched by immediate increases in British naval armament.

But by the summer of 1914, with the Kiel canal ready and Great Britain to all appearance rent by internal quarrels and the threat of civil war in Ireland, Germany no longer felt under the necessity of considering British intervention as a danger to her in case of war.

The personalities of Conrad, at the head of the armies of the Austrian empire, and Berchtold, the Austrian foreign secretary, had a direct influence on the situation, for both were, to say the least, willing to risk a general European war in their fanatical fear and hatred of Serbia and their belief in forceful measures to subdue her before she grew too strong.

The assassination of the archduke Francis Ferdinand, heir to the Austrian throne, together with his morganatic wife, at Serajevo, Bosnia, by a Serbian subject, Prinzip, on June 28, 1914, was seized upon openly by Austria and covertly by Germany as a *casus belli*. The German emperor, William II, was at that time attending the Anglo-German naval manoeuvres in the Kiel canal, but left on receipt of the news, and the manoeuvres were cancelled.

Austrian Note to Serbia

On July 5 the emperor pressed Austria not to lose a moment which was so favourable to her, and promised to support her in the event of any move by Russia. He gave his opinion that such a move was unlikely as Russia was still unprepared for war and that France, too, would be unable to fight because of her bad financial position and her lack of heavy artillery. To Great Britain he did not allude. On July 5 and 6, after consultation with his military and naval advisers, he decided to make unostentatious preparations for war.

Austria drew up a merciless note to Serbia. It was delivered on July 23 during the period when the French president and premier were at sea, returning from Russia. On July 25 Austria broke off relations with Serbia and ordered 9 corps to

mobilise secretly, when all the ten demands in the note except two, which were referred to The Hague, had been accepted by the Serbian government, and William II himself declared that all ground for war had been removed.

OPENING OF HOSTILITIES. To confront Europe with the accomplished fact of war was now the plan of Berlin and Vienna. Francis Joseph was induced by falsehood (Berchtold told him that the Serbs had already opened hostilities) to sign the declaration of war with Serbia on July 28, and next day Belgrade, though an open town, was bombarded by the Austrians. Russia immediately announced (July 29) that a partial mobilisation of the Russian troops required to act against Austria would take place. This mobilisation had begun in secret on July 26, when the tenor of the Austrian note was known, and had proceeded parallel with secret preparations in Germany. Energetic efforts made by Great Britain to refer Austria's quarrel with Serbia to a conference of ambassadors were nullified by Germany.

Germany and Russia

On July 29 a German military council met at Potsdam, and the same day the German ambassador at St. Petersburg (Leningrad), then the capital of Russia, threatened Russia with war if she continued her partial mobilisation, which led the Russian staff later in the day secretly to order a general Russian mobilisation. The tsar answered the German threat by proposing that Austria should refer her dispute with Serbia to The Hague, a proposal which was rejected. Bethmann-Hollweg, the German chancellor, on July 29, indicated to Great Britain his intention of violating Belgian neutrality. Russia (at midnight of July 30-31) and Austria (at 1 a.m.) independently decided to proclaim general mobilisations. At noon of July 31, William II yielded to the pressure of the military party in Berlin and proclaimed a state of danger of war, automatically calling out large numbers of reservists. Late that night the German ambassador at St. Petersburg presented an ultimatum to Russia, threatening that Germany would mobilise if Russia did not demobilise in 12 hours. At 3.40 p.m. of Aug. 1, France proclaimed a general mobilisation and, independently of her action. Germany issued a similar proclamation at 5 p.m. At 7.30 p.m. Germany declared war on Russia falsely asserting that her troops had violated German territory.

The Italian government had warned Germany on July 24 that Italy's alliance had ended with the Austrian note to Serbia, and on July 31 it informed France that it would remain neutral. Great Britain, in the night of July 26, had ordered the fleet not to demobilise after the test mobilisation just carried out, and on July 29 the First Fleet left for Scotland to take up its war position.

German Moves to the West

At 8 p.m. of Aug. 1, German troops violated the neutrality of Luxemburg (an act of war, as this neutrality was guaranteed by France and Britain), and next day occupied Luxemburg and violated the French frontier at many points under orders from the staff. At 7 p.m. of Aug. 2, Germany delivered to Belgium her ultimatum, which had been prepared on July 26, and sent under seal to Brussels on July 29. It demanded within 12 hours permission to move German troops through Belgium on the false pretext that the French meditated an invasion of Belgian territory. At 6.45 p.m. of Aug. 3 the German government declared war on France.

Early on Aug. 4 the British government presented an ultimatum to Germany, requiring her before midnight to pledge her respect for Belgian neutrality. Bethmann-Hollweg replied that Belgian neutrality had already been violated by German forces, and complained that, "just for a word, neutrality, just for a scrap of paper, Britain was going to make war on a kindred nation." At midnight German time (11 p.m. of Aug. 4, British time), war began between Britain and Germany.

W. FRONT—OPENING PHASE. The German plan, in pursuit of which war was begun and Belgium invaded, was as follows: One German army (4 corps) was left in the E. to protect E. Prussia and co-operate with the Austrian forces, 600,000 strong, which were to attack Russian Poland. Austria was to move part of the armies, 500,000 strong, which she had directed against Serbia, back from the Serbian frontier to act against Russia. The main German strength was to be flung upon France and Belgium to annihilate the French armies before they could complete their mobilisation, and to reach Paris by a swift advance.

Behind this great advance reserve troops were to seize the Channel ports to prevent a British disembarkation, if the British did not act at once. To prepare for this move-

ment a German advance army was to enter Belgium and seize the junction and fortress of Liège. The Germans expected no serious resistance from Belgium, and after crushing France and dictating peace, intended to transfer the bulk of their army to the E., and then to force Russia to conclude peace. The Belgian resistance and the Russian advance into E. Prussia shattered this plan; 3 corps were detained in Belgium and at Maubeuge and 2 corps had to be sent to E. Prussia; and the absence of these corps brought the German defeat on the Marne. The German advance through Belgium was marked by many incidents of ruthless and savage cruelty towards the civilian population, which aroused the horror of the civilized world. (*See Belgium: History.*)

The French in their plans wrongly assumed that no great advance would be attempted by the Germans in W. Belgium; and that the German reserve divisions and corps would not be employed in the main attack.

As the result the Germans were able to place 1,750,000 well-equipped troops in line against French effectives of about 1,200,000 and completely to outflank the French. Yet in the French depôts there were 1,000,000 reservists without arms or equipment.

B.E.F. in France

While the British expeditionary force of two corps assembled at Maubeuge, five French armies were concentrated from Mézières to Belfort. This disposition left over 100 m. of the N. frontier of France unguarded and gave no aid to Belgium.

British sea-power asserted itself at the outset, enabling the two British corps to move to France and take their place in the French line. As no aid was given to the Belgians, the Germans advanced rapidly, taking Liège and Namur. The Germans passed S. of the Belgian forces, brushing them back on Antwerp, and then swept W., moving on Brussels and Valenciennes. Other German armies passed through the Ardennes.

The principal mass of the German armies turned both flanks of the British and the 5th French army and menaced them with envelopment. They detected the German intentions and eluded the blow by swift retreat. The respite gained by this retreat of 130 m. was used to rearrange the French commands and dispositions.

Joffre, the French c.-in-c., found himself too weak to fight on

the Somme, and a further retirement was ordered. The retreat to S. of the Marne lengthened the German line of communications, exhausted the troops, and gained time for Allied reinforcements to arrive. The French government withdrew to Bordeaux on Sept. 2.

Kluck with the 1st German army had orders to protect the German right and the exposed flank of Bülow's 2nd army. On Aug. 31 in response to directions from Bülow, he began to move S.E. across the Paris front in order to aid Bülow. This movement was approved by Moltke, the German chief of staff; the British were assumed to be out of action. The German cavalry reached Ypres, Lille, Arras, and Chantilly. On Sept. 2 the German command ordered Kluck to échelon his troops behind the 2nd army. He disobeyed and continued his inward movement so as to carry out the general object, which was "to drive the French S.E. from Paris." Galliéni, the governor of Paris, detected Kluck's movement; on Sept. 4 he began to reinforce the French army N.E. of Paris with troops from the Paris garrison. Orders were issued for the general attack on the Germans which brought the first battle of the Marne (*q.v.*).

E. FRONT—OPENING PHASE. The German plan in the east provided for an advance into Russia, assuming that the Russian army would not be able to act for two months and trusting Austrian assertions that the Austrian forces were superior to the Russians. The Austrian staff committed the mistake of striking at once with almost equal forces on two different fronts—against Serbia and Russia. The Germans were disagreeably surprised by the rapid advance of the 1st (Rennenkampf) and 2nd (Samsonov) Russian armies into E. Prussia, though Samsonov's force had not been properly mobilised, and the movement was undertaken with grave misgivings at the request of France.

Battle of Tannenberg

Rennenkampf drove back the German front in a sanguinary battle at Gumbinnen (Aug. 18–20) and moved towards Königsberg, but very slowly. Samsonov, advancing with five ill-equipped corps to the S. of Rennenkampf, was attacked by Hindenburg at Tannenberg; he was killed, while the greater part of his army was destroyed because of Rennenkampf's failure to support him. The Germans turned on Rennenkampf, who escaped with heavy loss by a hasty

retreat. But this campaign, despite its disasters, forced the German staff to send two corps E. on the eve of the Marne, and took pressure off the French.

The Austrian operations were marked by utter failure. Part of the Austrian 2nd army was recalled from Serbia on Aug. 18 to assist in protecting Lemberg (Lwów), but it arrived too late. The 1st and 4th armies, advancing into Poland, gained small successes. While they were moving N. two other Russian armies, 3rd (Russky) and 8th (Brusilov), struck at Lemberg, forced the Austrians defending that place to give battle in unfavourable conditions, and on Sept. 3 took Lemberg. The Austrians in Poland had to retire. On Sept. 6 another battle opened at Rawa Russka which closed with a fresh Austrian retreat and with the loss to the Russians of all E. Galicia.

The Russians advanced towards Cracow, after taking Jaroslav (Sept. 21) and investing Przemyśl (Sept. 24); at the same time they seized the Dukla Pass in the Carpathians. Falkenhayn, who had succeeded Moltke as chief of the German staff after the Marne, fearing an Austrian collapse and the loss of Silesia (vital to the German munition industry), determined to attempt an offensive in Poland under Hindenburg, in cooperation with the shaken Austrian forces, but had to retreat (Oct. 27).

Struggle before Warsaw

On Nov. 4 the investment of Przemyśl was renewed, and Russian cavalry entered Silesia. Once more the plight of Austria became desperate, and, to save her, Hindenburg struck at the Russian right flank and captured Łódź, while the Russians were also checked by the Austrians before Cracow and compelled to retire towards Warsaw, before which city a fierce struggle began (Dec. 7). In Feb., 1915, the Russian 10th army suffered a repetition of Tannenberg at Augustovo, losing 100,000 men; but, as an offset to this, the Germans were repulsed at Warsaw.

On the Serbian front the Austrian operations in 1914 were disastrous. Shabatz was occupied on Aug. 16, and an advance begun on Valievo; but the Serbians attacked (Aug. 17) and completely defeated their opponents. The Austrians retreated, evacuating Serbia, but began another offensive (Sept. 8), when they were again defeated. A third Austrian offensive opened in Nov., and issued in a fresh defeat at Mt. Rudnik (Dec. 8).

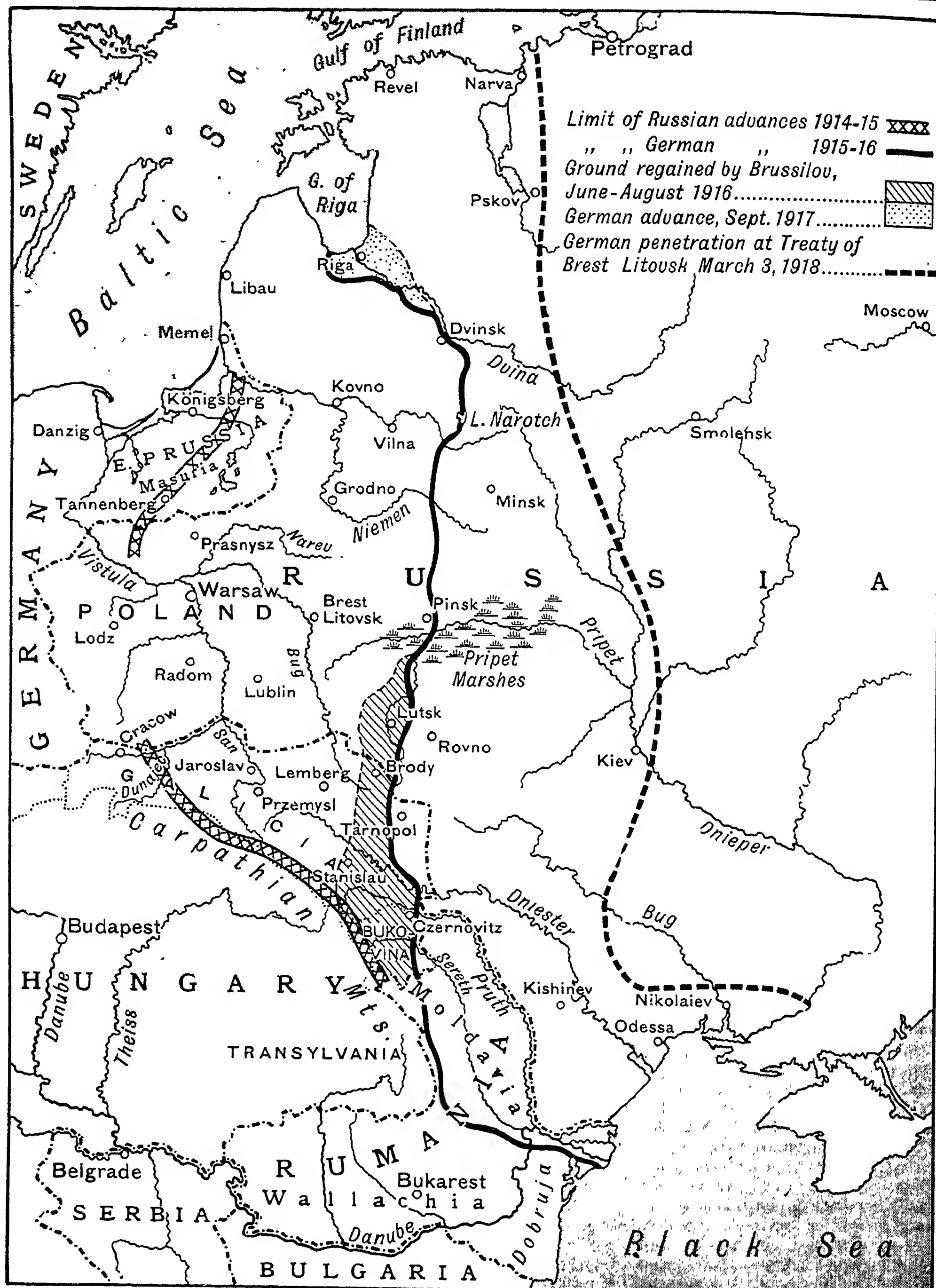
TRENCH WARFARE IN THE W. Beaten, but not by any means routed, on the Marne, the Germans fell back on positions N. of the Aisne, which they fortified and held for nearly four years, and trench warfare began on this section of front, after the failure of the Allies in a frontal attack to make any impression. The French command endeavoured to outflank the Germans to the W. in the "race to the sea," and thus to relieve Antwerp, but it was gravely handicapped by shortage of munitions which paralysed its efforts. The British force was moved (Oct. 3–19) from the Aisne to Flanders, a necessary consequence of the decision to raise a large British army.

Fall of Antwerp

Meantime, Antwerp fell (Oct. 9), and the German staff also made a determined attempt to outflank the Allies; it extended its right and strongly reinforced it with new corps, secretly raised and trained. The British 7th division landed at Zeebrugge in early Oct., but, unable to advance in face of large German forces, it entrenched at Ypres, and there bore the first shock of a violent German attack, which it beat off with a loss of 75 p.c. of its own strength. As the Germans maintained their pressure at Ypres, more British troops, with a number of French divisions, were brought up. The battle raged along the Allied left from the sea and Ypres as far S. as Armentières, and ended on Nov. 11 in deadlock. The Germans secured Zeebrugge and Ostend, but were prevented from seizing Calais and Boulogne.

The front in the W. now extended 500 m. from the sea to Switzerland, so that it could not be turned at either extremity. This condition led to indecisive battles until one side or other could obtain marked numerical superiority and the means of attacking machine-gun positions. The tactics of a breakthrough had to be worked out by experiment. In both Germany and France the manufacture of munitions (*q.v.*) was being pushed on a gigantic scale, but not until May, 1915, did Britain take adequate steps.

Allied attacks in the W. at Neuve Chapelle (March 10, 1915), Aubers and Festubert (May 9–16), Arras and the Champagne front, in the winter and spring, brought terrible casualties with the most trifling gain of ground. The British offensives proved that without something like unlimited supplies of high-explosive shells little could be achieved against



It should be noted that the lines on this map of the operations in the eastern area do not in most instances represent continuous battle fronts. For one thing, the trench system was never so highly developed as in the west; for another, they are intended to show limits of advance or retreat that were not necessarily contemporaneous. For instance, the advance of the Russians in E. Prussia in 1914 had been broken at Tannenberg before their maximum advance in Galicia was attained. Place names and boundaries shown here are those recognized 1914-18.

FIRST GREAT WAR: MAP SHOWING CAMPAIGNS ON THE EASTERN FRONT

the mass of German machine-guns mounted behind steel or concrete. The need to speed up production of shells led to the formation of a vigorous ministry of Munitions under D. Lloyd George.

In this period of preparation the Germans made a great attack at Ypres (April 18–May 24, 1915), memorable for the first use by them on the W. front of gas emitted from cylinders (they had already used gas shells before Warsaw with deadly effect). But for the magnificent heroism of the Canadian troops Ypres would have been lost. In the autumn a joint offensive had to be opened prematurely by the British (Loos, Sept. 25) in cooperation with the French (Arras and Champagne), with the object of relieving Russia. The gains were small, and the German front remained unbroken at the close of the year.

OTHER FRONTS. On the outbreak of war the German battle cruiser Goeben (*q.v.*) and light cruiser Breslau (*q.v.*), under Admiral Souchon, escaped up the Dardanelles, in violation of treaties and with the connivance of the Young Turks, who had concluded a secret alliance with Germany (Aug. 2). The defeats of the Germans and Austrians on the Marne and at Lemberg caused some hesitation on the part of the Turks, but on Oct. 29 Turkish torpedo craft bombarded Odessa without declaration and Turkey entered the war. As it was vital to protect the oilfields in W. Persia, from which the British navy obtained a large part of its fuel, a small British-Indian force landed at the head of the Persian Gulf (Nov. 21) and secured control of the Euphrates delta. The Turks attacked Russia in the Caucasus, but were defeated with a loss of 75,000 at Sarikamish (Dec. 25–28) and Kara Urgan (Jan. 10–16, 1915).

Gallipoli Campaign

These battles diverted Russian troops and munitions from Europe, and led the Russian government to appeal to Britain for a demonstration against the Turks. Such was the beginning of the ill-fated Gallipoli campaign, and of the dispersal of Allied forces in secondary areas. The naval attack on Turkish fortresses commanding the Dardanelles began Feb. 19 and continued until March 18. British and French troops landed on the Gallipoli peninsula on April 25. The campaign achieved nothing and the peninsula was evacuated Jan. 8–9, 1916. (*See Dardanelles; Gallipoli.*)

On May 23, 1915, Italy declared war on Austria, but her army was hampered by bad weather and want of munitions. Her forces did not press forward through the valleys, but attacked in the mountains on a narrow front, and made but insignificant progress. Yet Italy's action, coming at a moment when Russia was succumbing to defeat, diverted the attention of half a million Austrian troops. In the spring of 1915 eight fresh German divisions were sent to the E. with the object of attempting to break through the Russian front near its centre on the Dunajec and at Gorlice.

Allied Disasters of 1915

On Mar. 22 the Russian armies in Galicia reached the high-water mark of their advance with the capture of Przemyśl. Unfortunately, a whole Russian corps was being held ready to move against Constantinople in cooperation with the Allies at Gallipoli. A month later Hindenburg was ready. His subordinate Mackensen broke through the Russian front (April 28–May 2) at the chosen point, by means of an overwhelming artillery barrage. The Russians had neglected precautions and had no rear positions; that they escaped complete disaster was due to defective German strategy. The Germans took Warsaw (Aug. 5) and the Polish fortresses, overran all Poland, and pressed the Russians back to a line which ran from W. of Riga through Dvinsk to Tarnopol. In July, 1915, the German government attempted to induce the tsar to make peace, but the offer was rejected.

These disasters were followed by the overrunning of Serbia, in which Bulgaria joined. The Bulgarian government had signed (Sept. 6, 1915) a secret treaty of alliance with Germany, pledging itself to attack Serbia not later than Oct. 11.

THE WAR AT SEA. At the opening of the sea-war, the flow of supplies to Germany was somewhat impeded by the British cruisers; but as Germany had prepared for only a short conflict, the failure to institute a complete blockade was a grave mistake on the Allies' part. No such compunction was shown by the German cruisers. The German main fleet virtually withdrew from the war, leaving its submarines to prosecute a policy of attrition, but an almost "watertight" blockade of Russia was carried out by the Germans in the Baltic and the Turks in the Black Sea, with disastrous results to the Allies.

From time to time the Bight of Heligoland was swept by the British navy, and on Aug. 28, 1914, 3 German light cruisers and 1 destroyer were caught and sunk. After a period of inaction the German battle cruisers attempted a series of raids on the British E. coast, shelling Yarmouth at long range (Nov. 3, 1914), and Hartlepool, Whitby, and Scarborough (Dec. 16) on which occasion part of the British fleet had a narrow escape from the whole German force. On Jan. 24, 1915, the German battle cruisers were caught in the North Sea on the Dogger Bank (*q.v.*), and the Blücher was sunk.

German cruiser operations at the outset caused serious loss to British shipping. The only considerable German squadron at large in Aug., 1914, was von Spee's force on the China station, which included two good armoured cruisers. These sailed to S. America and off the Chilean coast destroyed Cradock's weak British squadron at Coronel (Nov. 1, 1914), but on Dec. 8 were caught by a powerful British force off the Falklands (*q.v.*) and destroyed.

Under the rules of the Declaration of London, 1909, almost all commodities vital to Germany could pass through the British cruiser lines; this Declaration had to be modified repeatedly, but it was not abandoned till July, 1916. From Feb. 18, 1915, the Germans proclaimed a submarine blockade of Britain; all vessels, including even neutrals, were liable to be sunk in a "barred zone" round the British Isles.

British Blockade of Germany

The British government, as a "retaliatory measure" declared (March 1) that it would prevent commodities of any kind from entering or leaving Germany. But owing to fear of neutrals, especially the U.S.A., large quantities of supplies were permitted to reach Germany. The blockade did not become watertight until 1917, after the U.S.A. had entered the war. Thus, for the first 2½ years, Germany was not subjected to the pressure which the supreme naval power, Great Britain, might have exerted.

Throughout the war the German batteries on the Belgian coast were bombarded with little result. At the Dardanelles, forts once more proved their superiority over ships. In the Black Sea and Baltic there was continual skirmishing; the Russian fleet in the Baltic acted as a drag on the activity of the German fleet and was a perpetual

menace to N. Germany. British submarines entered that sea and inflicted some loss on the Germans, though attacks on the Pommern and Moltke, which were both hit by torpedoes, did not succeed in sinking them. In the Adriatic the Austrian fleet bombarded Italy.

In 1915 the most memorable event at sea was the sinking of the *Lusitania* (*q.v.*), May 7. In 1916, the German commerce-destroyer, *Moewe*, which had escaped in 1915, inflicted considerable damage on Allied shipping. *Lowestoft* was bombarded by the German battle cruisers (Apr. 25), but only trifling damage was done. This affair was intended to support the Sinn Féin insurrection in Ireland which broke out on Apr. 24. The German fleet was caught at sea (May 31), and the battle of Jutland (*q.v.*) was fought with indecisive result, the Germans escaping after inflicting far heavier loss than they sustained, though they were much inferior in strength.

WESTERN FRONT, 1916. At the close of 1915 the German staff decided to anticipate an Allied offensive in the W. by an attack on Verdun. This struggle for Verdun, in which the determined, ruthless onslaughts of the Germans and the epic heroism of the French were each far in excess of the worth of the position to either side, especially in view of the very heavy casualties (over 300,000 on either side), opened on Feb. 21, 1916, and was not abandoned until the following December. (*See Verdun.*)

First Somme Battle

A joint Anglo-French offensive had been planned for the close of the summer of 1916. Haig, the British c.-in-c., favoured attack on the Yser near Ypres, where the Germans could not have fallen back without abandoning their bases on the Belgian coast. Difficulties of terrain and of co-operation with the French prevented this. It was then determined (Feb. 18) that a great attack should be delivered on both banks of the Somme. The British army was in a better position to carry out such a plan because (May, 1916), after many hesitations, the British government had imposed compulsory military service for the first time since 1815.

The attack had to be delivered earlier than had been intended, in order to relieve the French at Verdun; and the French force had to be reduced owing to the large number of men absorbed at Verdun. Opening on July 1 on a

20-mile front, it resolved itself into a series of assaults on fortified villages, each of great strength. The moral effect was marked; Falkenhayn was removed and replaced as chief of staff by Hindenburg (Aug. 29). But with continuous rain the Somme battlefield gradually became a morass. The tanks, a British invention, making their first appearance in small force with untrained crews (Sept. 15), disappointed hopes, partly because their tactics had not been worked out, partly because the terrain was unfavourable, and partly because the high command did not immediately appreciate the potentiality of the new weapon. (*See Somme; Tank.*)

E. FRONTS IN 1916. Contrary to German wishes and without previously informing the German command, the Austrians opened a great offensive from the Trentino (May 15, 1916), advanced to Asiago, and threatened the whole Italian position in Venetia. Brusilov, commanding a group of Russian armies, opened fire on a front of 200 m. (May 31); on June 4 his infantry assaulted and broke into the Austrian front, compelling the recall of troops and guns from Italy. The Italians, when the Austrians weakened in their front, captured Gorizia (Aug. 9).

With furious energy Hindenburg reorganized the German armies and hurried reinforcements to the E. to support the demoralised Austrians, who were surrendering by the thousand. The "elastic system," or defence in depth, was ordered on the Somme, by which the Germans were to fall back slowly after inflicting the maximum of loss on the British. Brusilov entered Stanislau (Aug. 10), but already the discipline of his troops was failing; ammunition was running low; and German troops were arriving and entrenching strongly. His advance died away, after he had taken 350,000 prisoners.

Rumania Joins the Allies

Rumania at this juncture joined the Allies—too late. Her army, formidable on paper, lacked modern equipment and munitions. She had hesitated for many reasons—because she distrusted Russia, because her claims conflicted with those of Serbia, and because the Allies objected to her proposed strategy. The Russians wished Rumania to deliver the main attack on Bulgaria with the support of the large Allied army at Salonica. Rumania preferred to occupy Transylvania and called for an Allied offensive from Salon-

ica before she moved. This offensive Sarraïl, the Allied commander, was unwilling to promise, so long as Constantine of Greece threatened his rear. On Aug. 17, 1916, Rumania signed a military convention with the Allies by which she was to enter the war on Aug. 27–28. The Allies were unable to make any considerable advance from Salonica. All that was effected was the recovery of Monastir by the Serbians (Nov. 19), who had now re-entered the field. The Rumanians were quickly brought to a standstill in Transylvania. Bukarest fell (Dec. 6) and Wallachia, with its rich cornlands, was lost.

NIVELLE'S OFFENSIVE. In Dec., 1916, Joffre was replaced by Nivelle. By an Anglo-French agreement, Haig, with the British armies, was placed under Nivelle's command, and the British were required to extend their front, so as to give Nivelle troops for a great offensive which he intended. In Jan. and Feb., 1917, the British maintained their pressure, compelling the Germans to begin a considerable retreat to the Hindenburg line (*q.v.*), which Hindenburg hoped that his troops would be able to hold permanently and give time for the new "ruthless submarine campaign" to produce its effects. The Germans had fallen back to the Hindenburg line by early April, and the Allies had recovered 800 sq. m. of territory and the ruins of 100 villages and towns.

Arras-Vimy Offensive

Nivelle's plan provided for a great attack on the German position at Vimy Ridge by the British, who were to open the fighting in 1917, and were then immediately to transfer their offensive to Messines, previous to decisive operations against the Flanders coast, which was to be cleared to facilitate the campaign against the U-boats. The French, after the attack at Vimy had opened, were to assault the German positions on the Aisne, S. and S.E. of Laon. The Arras-Vimy offensive was carried out with extraordinary success. It opened on April 9, and might, by Ludendorff's admission, have brought the collapse of the German front and decisive victory, but for the weather. But the French attack on the Aisne (Apr. 16–20) failed (*see Aisne*), and the fighting at Arras had to be prolonged, though the British captured a large section of the Hindenburg "switch" line.

Nivelle was removed from command (May 15) and replaced by

Pétain, who was of opinion that the French army was in no position to continue a large-scale attack, in view of the mutinies which occurred about this time among certain units. It was decided to await the arrival of American troops (the U.S.A. having now entered the war) before attempting a great joint offensive against the Germans. The British arrangements had been dislocated and much time had been lost, so that the transfer of Haig's offensive to Flanders could not be carried out until weeks had passed. In April, 1917, the German staff was only with difficulty prevented from violating Dutch neutrality and seizing the mouth of the Schelde.

German Retreat in Flanders

To assist the French and cover the Russians, collapsing through the disintegration of the tsar's government and the outbreak of the revolution, the British steadily battered the German front. They stormed the Messines Ridge (June 7), regarded by the Germans as impregnable, with the small loss of 25,000 men. Before it was possible to renew the attack on the Ypres front the best weather of the year had gone, and the ground there had become as treacherous and difficult as that on the Somme. Over it raged a series of battles during the late summer and autumn, in which the Germans were slowly forced back with heavy loss, though the British casualties were also extremely heavy.

THE SUBMARINE MENACE. After Jutland there was no large-scale fighting at sea. The German light flotillas were active, raiding the Channel repeatedly, but in several of these raids they were severely handled by the Allies. In the winter of 1916 the German government decided, after long deliberation, to repudiate the promises it had given to the U.S.A. and prosecute ruthlessly its U-boat war—never really suspended. It based its decision on an assurance, given by the German admiralty, that Britain must collapse in six months or less. On Jan. 31, 1917, President Wilson was suddenly informed that Germany would close to neutrals the waters round Britain, France, and Italy, and would thenceforth observe no restraints. The American government at once broke off diplomatic relations, and when U-boats attacked and sank American ships, declared war (April 6).

The defeat of the U-boat campaign therefore became of over-

whelming importance, because it menaced the very existence of Britain (who in April, 1917, according to Admiral Sims, had only three weeks' supply of food), and threatened to prevent the armies of the U.S.A. from reaching Europe. Early in the campaign the British losses were grave, reaching a maximum in one month of 545,000 tons sunk (April, 1917), while Allied and neutral shipping suffered little less severely. But from July, 1917, the losses slowly diminished with the introduction of the convoy system and the use of new methods by the British navy and air service against the U-boats. Food was severely rationed in Britain; existing tonnage was used more effectively; new shipping was built.

The Strait of Dover was now closed to the U-boats by a barrage (*q.v.*), and a similar barrage was laid (March, 1918) across the Adriatic. Minefields were carried close in to the German bases, rendering it difficult for U-boats to pass in or out, and the Flanders bases were so constantly bombed and bombarded that U-boats were driven from them. The operations culminated in the successful sinking of blockships in the entrances to Zeebrugge (April 22-23, 1918) and Ostend (May 10). The new measures checked the U-boats and the British Admiralty was able to guarantee the safety of American troops crossing to Europe. Only 56 lives were lost through U-boat action during the movement of 1,500,000 men to France (March-Sept., 1918); and of these men 48.5 p.c. were carried in British ships.

The British naval strategy in the closing period of war was thoroughly successful. The Bight of Heligoland was heavily mined, causing a German loss of 100 vessels, and was continually patrolled by British naval forces.

U.S. Additions to Royal Navy

In Dec., 1917, four American dreadnoughts joined the Grand Fleet, raising its force to 51 vessels of this class against 23 German ships completed. In 1918 four more U.S. dreadnoughts were dispatched to Britain for reserve and convoy duty. So thoroughly was the inferiority of their fleet realized by the German seamen that when (Oct. 28, 1918) orders were given to it to go out and fight, the crews mutinied and thus compelled the German staff to surrender. The blockade of Germany was pressed with ever-growing severity.

The loss of British shipping during the war was 7,923,000 tons from enemy action and 1,132,000 from maritime casualties (which increased owing to the need of steaming without lights and other risks). Some part of this was made good by capture or purchase, leaving a net loss of 3,443,000 tons. The total world loss was 15,053,000 tons gross.

THE RUSSIAN DEFEAT. The outbreak of revolution (March 11, 1917) completed the demoralisation of Russia's armies. The fleet mutinied, and wholesale desertions on land and sea took place. A tacit truce was observed between the Russian and German forces; and all the plans prepared for Russian cooperation in the great offensives of 1917 failed just when the Austrians were making overtures for peace and the Germans were in the extremest difficulty. The whole of Galicia was swiftly recovered by the Germans, and their troops entered Podolia, a prov. of S. Russia (July 29), and proclaimed the independence of a new state, the Ukraine.

Treaty of Brest-Litovsk

The Germans, wanting troops for the W., did not pursue, but looked to the revolutionary extremists to do their work. They captured Riga (Sept. 3), and utilised their less efficient divisions to occupy the Ukraine, whence they hoped to draw supplies. The Russian war with Germany had virtually ceased, though a definite armistice was not signed until Dec. 15. The treaty of Brest-Litovsk with Germany and Austria was concluded on March 3, 1918.

The Russian collapse would have been fatal to the Allies had it not been delayed till a date when Britain had 5,000,000 men in service, the largest Allied army then existing. Its consequences were in part repaired by the entry of the U.S.A. into the war. But whereas Russia had large armies in contact with German territory exercising actual pressure on the Germans, the U.S.A. had no armies that counted in any part of the world. Many months were needed to train American troops and then they had to be transported to Europe. Not until Sept., 1918, did they begin to exert more than a moral influence.

MESOPOTAMIA AND PALESTINE. In Mesopotamia, the early British successes led to a premature movement up the Euphrates in 1915 to join hands with Russia and hold the Turks. A rash advance on Bagdad by a British-Indian force of one division was followed by a

retreat to Kut (*q.v.*). Maude was appointed to the command of the British army of Mesopotamia, and strongly reinforced from India; and at the close of 1916 he advanced and after a brilliant campaign entered Bagdad (March 11, 1917). This campaign, though a secondary one, produced considerable effect in exhausting Turkey and preparing for terrific blows which Allenby afterwards dealt her in Palestine.

Capture of Jerusalem

In Aug., 1916, the Turks made an attempt, their second, to invade Egypt from Palestine (then part of the Turkish empire), but were defeated at Romani, and thenceforward the British advanced slowly, constructing a railway and pipe-line for water across the desert to the Palestine frontier, capturing El Arish (Dec. 21), Rafa (Jan. 9, 1917), and reaching Gaza, where, after two days' fighting, their progress was stopped (March 26-27). A second attack on Gaza (April 19, 1917) failed. Allenby was placed in command and seized Beersheba (Oct. 31). He attacked once more at Gaza (Nov. 1-5), forcing the Turks to abandon that vital strategic point. He then worked round Jerusalem, the loss of which city (Dec. 9, 1917) was a catastrophe for the Turks. Meantime, in June, 1917, a change of importance had taken place in the Balkans. Constantine was deposed from the Greek throne, and Greece, led by Venizelos, entered the war on the side of the Allies.

CAPORETTO AND CAMBRAI. The Austrians on land were completely defeated by the Italians on the Isonzo (Aug., 1917). This compelled the German staff very reluctantly to strike at Italy and send 7 German divisions to the Italian front. The Italians asked for British and French reinforcements and heavy artillery; some guns were lent temporarily, but, as the Americans were not then ready to place any considerable force in line, troops could not be spared from France. The Germans broke through the Italian front near the S.E. end at Caporetto (Oct. 24); the strategic position was such that the whole force had to fall back (*see* Piave). To meet the overwhelming danger strong reinforcements were sent to Italy from the W. front (5 British and 6 French divisions). The whole of N. Venetia was lost.

The battle of Cambrai (Nov. 20), fought by Haig to hold the Germans on the W. front and support the Italians, modified the whole system of tactics and restored the element of surprise. So complete

was its initial success, attained by the advance of 400 tanks, that if fresh troops had been available to exploit the victory, the German line might have been broken finally. The opportunity could not be used; the Germans concentrated and counter-attacked (Nov. 30), recovering much lost ground.

GERMAN OFFENSIVE OF 1918. Owing to the collapse of Russia, the Germans were able to move all their good troops to France, where 34 divisions arrived from the E., replacing tired units and raising the total German strength in the W. to 197 divisions against an Allied strength of 169 divisions. For the first time since Sept., 1914, the Allies had no superiority in numbers. The weakest part of the Allied front was the British line between Cambrai and the Oise held by Gough's 5th army. Its S. section had been previously in the hands of the French, and had been captured during the German retreat of 1917. It had not been provided with good rear-defences, as it had been taken over only in Jan., 1918, and the supply of labour was inadequate. It was at this point that the Germans decided to make their first thrust.

The German command was now aware that the U-boat campaign had failed; and if the war was to be won, the only possible resource was to destroy the British and French armies, by severing them and rolling up the British army first. It believed that the French troops were tired and that the morale of the British had been shaken by propaganda behind the line. The actual attack opened on March 21, 1918, by which time Foch had been appointed supreme commander of the Allies in the W.

"Backs to the Wall"

On April 9 the Germans attacked at Armentières, driving a deep wedge, which they steadily widened, into the British front. They captured the Messines Ridge, thus imperilling the British position at Ypres and the defence system of the Channel ports. They took Kemmel Hill (April 25) from the French. The position could scarcely have been more critical. It was on April 11 that Haig (*q.v.*) issued his "backs to the wall" order, and the troops responded with surpassing spirit. Again the German attack died down.

During this offensive the Germans made slight gains near Amiens which brought them within 7 miles of that vital point and enabled them to keep the main

railway to Paris under constant fire. But the Australians beat off all further attacks and even won some ground.

The Germans renewed their attack on May 27, when with 25 divisions they attacked 4 weak British and 4 tired French divisions on the Aisne, between Soissons and Reims, and reached the Marne once more on a front of 10 m. E. from Château-Thierry. Extending this advance, they gained a point only 45 m. from Paris, which city they had bombarded from March 23 onwards with special long-range guns installed near Laon and firing at a distance of 70 m. At the same time they carried out large-scale air raids on Paris.

Turn of the Tide

Early in June, Foch had to effect withdrawals between Montdidier and Château-Thierry before German pressure, but though the Germans appeared on the eve of success, on June 13-14 they were stopped. This was in reality the passing of the crisis, and the Allies had now a slight numerical advantage. On July 2 the American government announced that a million Americans had already sailed for Europe, so that Germany had not a moment to lose.

The German front at this moment formed a vast semi-circle, bulging into the Allied front, so that the German staff could strike at any point and hold their reserves in a central position which would not betray their intentions. Foch, however, obtained accurate information as to the place and date of the intended offensive, and took admirable measures to meet it. Delayed by stormy weather, it was not until July 15 that the Germans advanced.

For the second time in the war the Marne proved itself a river of fate; the Germans crossed it, but were heavily repulsed at Reims, and S. of the Marne they were quickly brought to a standstill N.W. of Épernay. This was the high-water mark of their advance. By July 16 the German staff knew that the attack had failed.

FINAL BATTLES. Foch's preparations for a return stroke were complete. Early on July 18, French and American divisions delivered a sudden attack on the exposed German flank between the Aisne and Château-Thierry. They forced a German retreat across the Marne. Foch pressed the Germans continually, and drove them steadily, if slowly, back, while French, British, American, and Italian

troops attacked on both sides of the Marne salient, and endeavoured to hold the enemy and pinch him off.

The German reverse on the Marne had great effect in shaking Austrian and Bulgarian confidence, and on Aug. 3 the German staff admitted "our strategical plan of attack had failed."

On Aug. 8, Haig and the British, with the 1st French army co-operating, attacked before Amiens, employing 400 tanks. The Germans were completely surprised, and 6 or 7 German divisions of high quality were destroyed, and the severest defeat of the whole war up to that date was inflicted on the German army. Montdidier was retaken by the 3rd French army, which attacked when the Germans elsewhere gave way.

The British "Hundred-Days' Battle" had begun. From Aug. 8 Haig maintained his persistent assault on the German front with only the briefest intervals for the repair of the railways and roads. Such attack was made possible because of the unity of command and the abundant supply of munitions now at his disposal.

Germany's Desperate Efforts

Ludendorff pressed both Austria and Bulgaria to send reinforcements to the W. front. Bulgaria refused, and Austria could be induced only to send artillery and to promise a few divisions, which were speedily engulfed in the general disaster. All the difficulties of the German staff were accentuated by a brilliant attack delivered by the French between Noyon and Soissons (Aug. 20). The British pressed their advantage, attacking with equal violence on the old Somme front, and retaking Albert. On Aug. 21-26 they attacked and captured the important positions abutting on the N. end of the advanced Hindenburg (or Wotan) line, near Arras.

The Wotan line itself was stormed by Canadian and British troops (Sept. 2). The Germans were flung back on the main Hindenburg line of fortifications before Cambrai, which were of extraordinary strength, and had the advantage of water-protection in their front as a security against tanks. The German armies were showing signs of exhaustion, and Ludendorff bitterly complained that he was not properly supported by the civilians in the government.

At this juncture the Americans under Pershing began their first large scale operation (Sept. 12), and captured the deep salient in

the Allied front at St. Mihiel, and cleared the great Paris-Arricourt double-track railway which Foch wanted for the development of his manoeuvres. Simultaneously the British closed upon Cambrai and made ready to assault the enormous Hindenburg works, and to force the defences of that pivotal point and junction.

This was the gravest operation of the whole Allied offensive, and there were many doubts as to whether it could succeed, such were the natural and man-made obstacles. The prelude was the opening of a great American offensive on both sides of Verdun, through the Argonne region of forest, hills, and swamps, a terrain of the greatest difficulty, rendered more difficult than ever by heavy rains. The French supported this offensive by an attack W. of the Argonne, so that the Germans were held firmly.

Covered by an unexampled concentration of 4,200 guns, the British began the storming of the Hindenburg line. The Canal du Nord was crossed (Sept. 27), and the British pushed clean through the Hindenburg line near its N. end. On Sept. 28 the battle-front was prolonged by an Allied advance in Flanders which captured the Messines ridge, cleared Ypres, and resulted also in a great gain of ground. On Sept. 29 the British crossed the St. Quentin canal (S. of Le Catelet), and broke the Hindenburg system S. of Cambrai, the same day the Canadians fought their way into the suburbs of Cambrai.

Bulgaria Sues for Armistice

Meanwhile, on Sept. 15 the Allies on the Salonica front attacked the Bulgarians N. of Monastir. The Serbians broke right through the Bulgarian front, while the British and Greeks pinned down the forces before them, in the immediate N. of Salonica. Owing to the dash and determination of the Serbians the victory became a decisive one (Sept. 21).

On Sept. 26 the Bulgarian government asked for an armistice, which was signed on Sept. 29. The news of this surrender caused financial panic in Germany, as with it railway communication between Germany and Turkey was cut and the fall of Turkey at an early date assured. Rumania had been compelled by the defection of Russia to sign an armistice with Germany (Dec., 1917), followed by a definite peace. Throughout early 1918 the Austrian emperor Charles had been anxious for peace owing to grow-

ing internal difficulties and want of food. In June, to obtain supplies which the Germans would grant on no other conditions, he was forced to undertake an offensive in Italy. The support of 100,000 German troops had originally been promised him by Ludendorff, but owing to the failure of the earlier German offensives in France to secure decisive results, they could not be sent.

Austria and Turkey Collapse

On Sept. 15 the Austrian emperor issued a peace note, which the Allies rejected, and orders were issued for a great Italian offensive. The battle of Vittorio Veneto (*q.v.*) ended the Austrian resistance, and on the night of Nov. 3 the Austrians signed an armistice. The surrender of Turkey preceded that of Austria by a few days.

On Oct. 1 Ludendorff urged the German government to open negotiations for an armistice in the W. as quickly as possible. The civilians of the German government thought he had lost his nerve completely, but many other officers at the German headquarters shared his view. Prince Max of Baden was appointed chancellor and attempted to open negotiations with President Wilson, on the basis of his Fourteen Points (*q.v.*) set forth in Jan., 1918.

The British continued their advance. On Oct. 8 they opened the battle of Le Cateau, and captured Cambrai on the following day. The whole German line tottered; Laon, a vital junction, fell to the French (Oct. 13); Roulers, in Flanders, was taken on Oct. 14, and Menin on the following day. In danger of envelopment, the Germans abandoned the Flanders coast, and the Allies occupied Ostend (Oct. 17) and Zeebrugge (Oct. 19). The Germans had to evacuate Lille and Douai on Oct. 17, and the Allies recovered Tourcoing and Roubaix next day. On Oct 17 the British broke through the German front on the Selle. On Nov. 1 they opened the battle of the Sambre, which brought the recovery of Valenciennes and an advance over the old battlefield of Mons. That place was captured, and passed by the British just as the armistice came into force (Nov. 11).

Meantime, the French had pushed forward on the section of front between the main British attack and the American Argonne advance. The Americans pressed N., threatening more and more the German line of retreat. They took Stenay (Nov. 4), and continued their

progress till they reached the suburbs of Sedan.

Germany now knew she was beaten—not only in the military field but by the severe pressure of the Allied blockade, which crippled her production. In the long struggle of attrition by exhaustion of man-power, she was faced with the prospect of meeting the new and vigorous reserves of man-power from the U.S.A., as yet scarcely tapped. The inescapable facts were pressed home by intensive British propaganda.

To obtain peace, the German government on Oct. 20 ordered its U-boats to cease attacking passenger ships; it was warned by President Wilson (Oct. 23) that the only possible armistice would be one rendering a renewal of the war out of the question, and that the Allies could never trust William II. The American president had previously referred the Germans to the Allied military advisers for the conditions. Ludendorff resigned on Oct. 27. On Nov. 7, revolutionaries seized Kiel and Hamburg, and German delegates left for Foch's headquarters to negotiate the terms of the armistice. When informed of the conditions settled for them, they protested vehemently, but their Government on Nov. 10 announced by wireless its acceptance. William II had abdicated under pressure on Nov. 9; he fled to Holland, accompanied by the crown prince.

Conditions of the Armistice

The main condition of the armistice (signed 5 a.m., Nov. 11) were: Cessation of operations six hours from signature. Evacuation within 15 days of Belgium, France, Alsace-Lorraine, and Luxemburg by all German forces. Repatriation of all prisoners and civilians taken by the Germans. Surrender by them of 2,500 heavy and 2,500 field guns, 25,000 machine-guns, 3,000 mine-throwers, and 1,700 aeroplanes, including all night-bombing machines. Evacuation by the Germans and occupation by the Allies of all German territory W. of the Rhine, with, in addition, bridgeheads of 20 m. radius on the E. bank of the Rhine at Cologne, Coblenz, and Mainz, to which other bridgeheads at Kehl (opposite Strasbourg) and Mannheim were afterwards added. Surrender of 5,000 engines, 150,000 wagons, and 5,000 motor-lorries.

Reparation for damage done to be paid, "all future claims and demands of the Allies remaining unaffected." All submarines to be

surrendered. Six battle cruisers, 10 battleships, 8 light cruisers, and 50 destroyers to be interned under Allied surveillance, and all other German warships to be disarmed. The blockade to continue till definite peace; German minefields to be removed; all naval aircraft to be immobilised. All territory outside Germany to be evacuated. The duration of the armistice, for 36 days in the first place, was repeatedly extended until the treaty of Versailles was signed (June 28, 1919). On Nov. 21, 1918, the German surface ships arrived at Rosyth for internment; their crews scuttled most of them at Scapa on June 21, 1919.

The confusion in the German rear was great; transport and supply were breaking down; roads were choked; troops were deserting; losses in men and material had been irreparable. All the German monarchies had fallen. Foch's forces when the armistice was signed held a line E. of Ghent, Mons, Maubeuge, and Hirson, thence turning S.E. through Mézières, Sedan, Stenay, and Ornes to S. of Metz.

THE AIR WAR. The bombing attacks by Zeppelins and aeroplanes upon the civilian populations of British and French cities throughout the war are described in the article Air Raids, as are the later raids made on industrial centres in Germany by Allied aircraft. In Great Britain the Zeppelin arm was met and broken in the autumn of 1916, but the menace from the aeroplane developed steadily. As the British government refused, until late in 1917, to carry out reprisals, the Germans derived great advantage from this air war. They neutralised and held fast in England some 100,000 men with large numbers of machines, absorbed in defence. The importance of air warfare grew daily and was felt at Arras and Messines, where the British airmen carried all before them; but the Germans maintained a determined competition to the end. (See Royal Air Force; Royal Flying Corps.)

THE GERMAN COLONIES. The German colonies were attacked early in the war, and one after another were captured, though not without severe fighting in some cases. The German fortress of Tsingtau (Kiao-chau), on the E. coast of China, was captured by a Japanese expedition, aided by a small British contingent, on Nov. 7, 1914. Japan had declared war on Germany (Aug. 23, 1914)

and cooperated in the convoy of British forces to Europe and in the cruiser operations in the Pacific and Indian Oceans against von Spee and the Emden, but she took little further part in the war, beyond sending a number of destroyers to the Mediterranean, where they did excellent work against the U-boats. She occupied the Caroline and Marshall Islands in the Pacific. Samoa was seized by New Zealand troops, and German New Guinea and adjacent islands by Australian troops, aided by the Australian navy.

Germany's African Possessions

Of the vast German territories in Africa, Togoland was conquered by the British and French in 1914 and was divided between them. Cameroons was occupied by British and French forces in 1916. German South-West Africa, one of the most valuable of the German colonies, equipped for a base against the Union, was reduced by Botha and Smuts in a remarkable campaign which closed July 9, 1915. South-West Africa was thenceforward administered by the Union of South Africa.

In German East Africa, owing to the great extent of territory, the destruction of the German forces was difficult. British, Belgian, and Portuguese forces cooperated, and by the close of 1916 the coast and central railway to Tanganyika were in Allied hands. But the war smouldered on, though the German forces were small, and at the armistice there were still about 1,500 German and native troops in arms.

THE BRITISH CAMPAIGNS. The burdens supported by the British and the services they rendered to the Allies will best be understood from the official list of 26 campaigns in which British troops took part, issued by the Army Council. They were: France and Flanders, 1914-18; Italy, 1917-18; Macedonia, 1915-18; Dardanelles, 1915; Sudan, 1916; W. Egypt, 1915-16; E. Egypt and Palestine, 1914-18; Hejaz, 1916-18; S. Arabia, 1914-18; Mesopotamia, 1914-18; S. Persia, 1915-19; E. Persia, 1915-19; N.W. Persia and Caspian, 1918; N.W. India, 1914-18; Murmansk, 1918-19; Archangel, 1918-19; Siberia, 1918-19; China, 1914; Australasia, 1914; E. Africa, 1914-18; S.W. Africa, 1914-15; Togo, 1914; French W. Africa, 1917; Cameroons, 1914-16.

RESETTLEMENT OF EUROPE. The treaties which formally ended the war were those of Versailles,

concluding peace with Germany, June 28, 1919, ratified Jan. 10, 1920; St. Germain-en-Laye, with Austria, Sept. 10, 1919, ratified July, 1920; the Trianon, with Hungary, June 20, 1920, ratified a year later; Neuilly, with Bulgaria, Nov. 27, 1919; and Sèvres, with Turkey—though this last was never operative, being signed at Constantinople in Aug., 1920, by a Turkish government with no real authority; it was superseded by the treaty of Lausanne, July 24, 1923. These treaties are dealt with in greater detail under their own headings.

Europe after the War

The Versailles treaty established the League of Nations (*q.v.*), which for the next 20 years was to exert a varying weight of influence on the direction of international affairs. The German empire of the Hohenzollerns collapsed, as did the Austro-Hungarian empire of the Hapsburgs. Germany became a republic. She lost all her overseas colonies, mostly to Great Britain and France, returned Alsace and Lorraine to France, and underwent several modifications of her boundaries in favour of Belgium, Lithuania, and reborn Poland. Austria and Hungary became two states, each republican in form. The area of Austria was greatly diminished by the cession of territory to Italy and to the new states of Czecho-Slovakia and Yugoslavia, created in pursuance of Wilson's policy of the right of self-determination. The old kingdom of Poland re-emerged as an independent republic, with a "corridor" to the Baltic. The defeated Russian empire was rent by violent revolution and had ceased for the time being to hold any place in world councils. Her break-up permitted the establishment of the four Baltic independent republics of Finland, Latvia, Lithuania, and Estonia.

Great Britain emerged from the struggle stronger in prestige and power. At the close of the war she had by far the strongest, best trained, and best equipped army in the field. The status of the British dominions was enhanced by their great contribution to the result, each receiving separate representation in the League of Nations, but the links binding them to the British crown were seen to be more firmly re-forged in the common endeavour. Palestine and Iraq were placed under British mandate by the League.

As already indicated, the financial loss entailed by the combat-

ants was unprecedented. Currency values throughout the world were deeply affected, depreciating in some countries with tragic swiftness. But more serious, because irremediable, was the loss to the world of 8,000,000 of its young manhood. In addition, large centres of population in central Europe were on the verge of starvation. Less easy to assess was the depreciation in moral and philosophical values, as seen in a wider substitution of cynicism and opportunism for the older ideals which had been based on a firm belief in human progress. Not only had the German aggression and wanton breaking of faith revealed the frailty of such influences as make for a higher form of civilization; but the length of the war, and its unprecedented horrors and squalors, had brought about a vast sense of disillusionment and an exhaustion of mental and moral effort, tending too often to a mood encouraging inertia. These tendencies were to cloud and hamper the world's activities for many years.

Bibliography. War Books: a Critical Guide, C. Falls, 1930, is a useful guide to the vast literature of the First Great War, but is incomplete in that it does not include books on the causes of the war or on the peace-making; moreover, many books, including at least one of the first importance, have been published since 1930. It has been stated that the British Museum library catalogue contains as many items on the First Great War as on the Holy Bible.

The British Official Histories, issued by the Imperial Defence Committee, fill many volumes, some of which had not been published even by 1947. They cover military operations in Egypt and Palestine (2 vols.), France and Belgium (14 vols.), Gallipoli (2 vols.), E. Africa, Mesopotamia (4 vols.), Togoland, and Italy; histories of all the divisions of the British army in the war (6 vols.), naval operations (5 vols.), the merchant navy (3 vols.), seaborne trade (3 vols.), air warfare (6 vols.); and medical services, etc. (12 vols.).

Other general historical surveys include Short History of the Great War, A. F. Pollard, 1920; Outline History of the War, G. V. Carey and H. S. Scott, 1928; Popular History of the Great War, 6 vols., ed. J. A. Hammerton, 1934. A history published during the war, and therefore subject to stringent censorship, yet valuable for its contemporary standpoint, is The Great War, ed. H. W. Wilson and J. A. Hammerton.

British Documents on the Origins of the War, ed. G. P. Gooch and H. W. V. Temperley, 11 vols., 1928-38, is an outstanding and

authoritative publication. Temperley's History of the Peace Conference, 1920-21, is a standard work.

More personal narratives, though each indispensable to full appreciation of the subject, are The World Crisis, W. S. Churchill, 6 vols., 1923-30, and War Memoirs, D. Lloyd George, 6 vols., 1933-36; also The Truth about the Peace Treaties, D. Lloyd George, 1938. Leading figures who contributed their memoirs were Lord French (1919), Lord Jellicoe (1919), Falkenhayn (trs. 1919), Ludendorff (trs. 1919), Tirpitz (trs. 1919), Hindenburg (trs. 1920), Kluck (trs. 1920), Scheer (trs. 1920), Townshend (1920), Robertson (1921), the ex-Kaiser (trs. 1923), Masaryk (trs. 1927), Benes (trs. 1928), Prince Max of Baden (trs. 1928), Poincaré (trs. 1928).

Among innumerable other books of record and reminiscence may be mentioned The First World War, C. à C. Repington, 2 vols., 1920; Tanks in the Great War, J. F. C. Fuller, 1920; A Naval History of the War, Sir H. Newbolt, 1920; With the Russian Army, Sir A. Knox, 1921; Personalities and Reminiscences, R. L. Bullard, 1925; The Intimate Papers of Col. House, ed. S. Seymour, 4 vols., 1926-28; Gallipoli, J. Masefield, 1926 edn.; Revolt in the Desert, T. E. Lawrence, 1927; My Mystery Ships, G. Campbell, 1928; Haig, Duff Cooper, 2 vols., 1935-36.

More philosophical or psychological in their study of individual human reaction to the war are such "literary" books as A Private in the Guards, S. Graham, 1919; Realities of War, Sir P. Gibbs, 1920; Disenchantment, C. E. Montague, 1922; Undertones of War, E. Blunden, 1928; The Weary Road, C. Douie, 1929; War Letters to a Wife, R. Feilding, 1929; Memoirs of an Infantry Officer, S. Sassoon, 1929.

The following novels dealing with the war may be cited as "documents" of some value: Mr. Britling Sees It Through, H. G. Wells, 1916; Under Fire, H. Barbusse, trs. 1918; The Secret Battle, A. P. Herbert, 1919; The Four Horsemen of the Apocalypse, V. Blasco Ibañez, trs. 1918; The Barber of Putney, J. B. Morton, 1919; Command, W. M'Fee, 1922; Some Do Not (1924), No More Parades (1925), A Man Could Stand Up (1926), and Last Post (1928), all by F. Madox Ford; The Spanish Farm Trilogy, R. H. Mottram, 1924-26; These Men Thy Friends, E. Thompson, 1927; The Case of Sergeant Grischka, A. Zweig, trs. 1928; War, L. Renn, trs. 1929; All Quiet on the Western Front, E. M. Remarque, 1929; Class 1902, E. Glaeser, trs. 1929; Her Privates We, "Pte. 19022," 1930; All Our Yesterdays, H. M. Tomlinson, 1930; The Patriot's Progress, H. Williamson, 1930. The "soul of the war" is also revealed in the works of various soldier-poets, e.g. Blunden, Grenfell, Hodgson, Nichols, Owen, and Sassoon, as it

is in the paintings of such artists as Orpen, Nevinson, John and Paul Nash, Kennington, H. S. Williamson, and many others whose work is exhibited in the Imperial War Museum, London.

A remarkable phenomenon was the sudden vogue in Great Britain for books about the war, especially fiction, in 1929-30, until the public was surfeited and the demand and supply ceased as suddenly as they began. It was the more strange in view of the unpopularity of the same subject during the preceding ten years, although a few outstanding war novels had appeared, only to be neglected. The change in taste was due in part to the success on the London stage of R. C. Sherriff's war play *Journey's End*, and in part to the extensive advertisement given in 1929 to E. M. Remarque's *All Quiet on the Western Front*, which sold extravagantly. Very little of the flood of war books which followed merited permanence.

First Offender. A legal term. In England at common law there was always jurisdiction to bind over any offender to be of good behaviour. But since many magistrates seemed to ignore this, the First Offenders Act, 1887, was passed, giving all courts of criminal jurisdiction power to bind over first offenders instead of punishing them. The Probation of Offenders Act, 1907, extended this power to all cases, whether first offences or not; and gave the court power to order any first offender to be placed under the supervision of some person named (generally the probation officer) for a period. The order may also provide that the offender shall abstain from intoxicating liquor, and may prescribe conditions as to his residence. See *Borstal System*; *Children*.

First of June, BATTLE OF. Fought in 1794, the first great naval action in the War of the French Revolution. France, though victorious on land, was in a situation little short of desperate. It was the epoch of the Terror, the harvest of the previous year had been poor, and famine was threatened. The British blockade was crippling supply. The Committee of Public Safety had endeavoured to relieve the situation by purchasing grain in the U.S.A., and a convoy of 116 vessels was dispatched, which approached the French coast towards the end of May. Rear-Admiral Nielly was sent out to meet the convoy, which Lord Howe was instructed to intercept.

The main French fleet, under Admiral Villaret-Joyeuse, left Brest on May 16 to cover the

arrival of the great grain convoy, and it was not until the 28th that Howe sighted his adversary. A good deal of fighting preceded the great action of June 1, in which Howe's fleet was shown to be the superior fighting force. His plan was to attack the enemy in line, van to van, centre to centre, and rear to rear, to break through the opposing line, and fight to a finish on the lee side. His ships were to pass through the intervals in the French line, but approach was slow, and the order could not be completely executed.

The *Bellerophon*, Russell, Royal Sovereign, and other ships attacked to windward, and several French ships thus slipped or were driven away. The *Marlborough* and *Queen Charlotte* (Howe's flagship), broke through the line, and delivered their broadsides with shattering fire. Captain Harvey, in the *Brunswick*, endeavoured to drive through the French line, but brave Captain Renaudin, in the *Vengeur*, stopped his way and the two ships were locked together in a furious struggle which has become famous, until the *Vengeur*, swept and broken by fire, went down with all her company. At every point the action was fought with the utmost gallantry and resolution on both sides. Six prizes remained in English hands, and the success, if not decisive, was enough. For two years to follow there was no great action at sea. The French, too, claimed a victory, for their fleet had not been destroyed, and their convoy reached Brest in safety.

This battle was the "glorious first of June," a phrase first used in an explanatory pamphlet accompanying two contemporary prints of the action by Robert Cleveley (1747-1806).

First Republic. Name given in France to the period 1792-1804. See *French Revolution*; *Napoleon*.

Firth. Name given to an arm of the sea in Scotland. Most of them are estuaries or gulfs into which rivers discharge themselves, e.g. firths of Clyde, Tay, and Forth, but Pentland Firth is a broad strait or channel. Firths are, as a rule, valleys which have been flooded by the sea.

Firth, SIR CHARLES HARDING (1857-1936). A British historian. Born in Sheffield, March 16, 1857, he was educated at Clifton and Balliol College, Oxford. He became fellow of All Souls, 1901, and was chosen in 1904 to succeed York Powell as regius professor of modern history at Oxford. He

edited Ludlow's *Memoirs*, 1894, *The Clarke Papers*, and *The Memoirs of Colonel Hutchinson*; wrote monographs on *Cromwell*, 1900; *Cromwell's Army*, 1902; and continued S. R. Gardiner's unfinished history of the Commonwealth and Protectorate. Firth's work threw much light on the middle decades of the 17th century. He was knighted 1922, retired 1925, and died Feb. 19, 1936.

Firth, MARK (1819-80). British manufacturer. Born at Sheffield, April 25, 1819, he was the son of an artisan in the steel industry. In 1843 his father, brother, and himself together opened a steel furnace. Mark was the moving spirit of this enterprise, and soon made it one of the largest concerns in Sheffield. The Norfolk Works were built to cope with the increasing business, while others were erected outside the city. Firth died Nov. 28, 1880. Known as a philanthropist, he built almshouses at Ranmoor, and founded Firth College, the nucleus of the university of Sheffield.

Fisc (Lat. *fiscus*, treasure chest). Term used in England in the Middle Ages for what is now the treasury, the account into which the public revenues are paid. From it comes the more familiar word *fiscal*. See *Fiscus*.

Fischart, JOHANN (c. 1545-90). German satirist. He was born in Alsace, and studied at Worms. He travelled in Holland, England, France, and Italy, and studied law in Strasbourg; he had already published lampoons and satires against the Jesuits and others, and a free rendering of *Gargantua* into German, 1575, when he was appointed magistrate at Forbach, near Saarbrücken, 1583. Under various pen names, Fischart did good service to the Lutheran movement. The best known of his reprinted works is the simple verse narrative *Das Glückshafft Schiff von Zürich* (*The Lucky Boat of Zürich*), 1576.

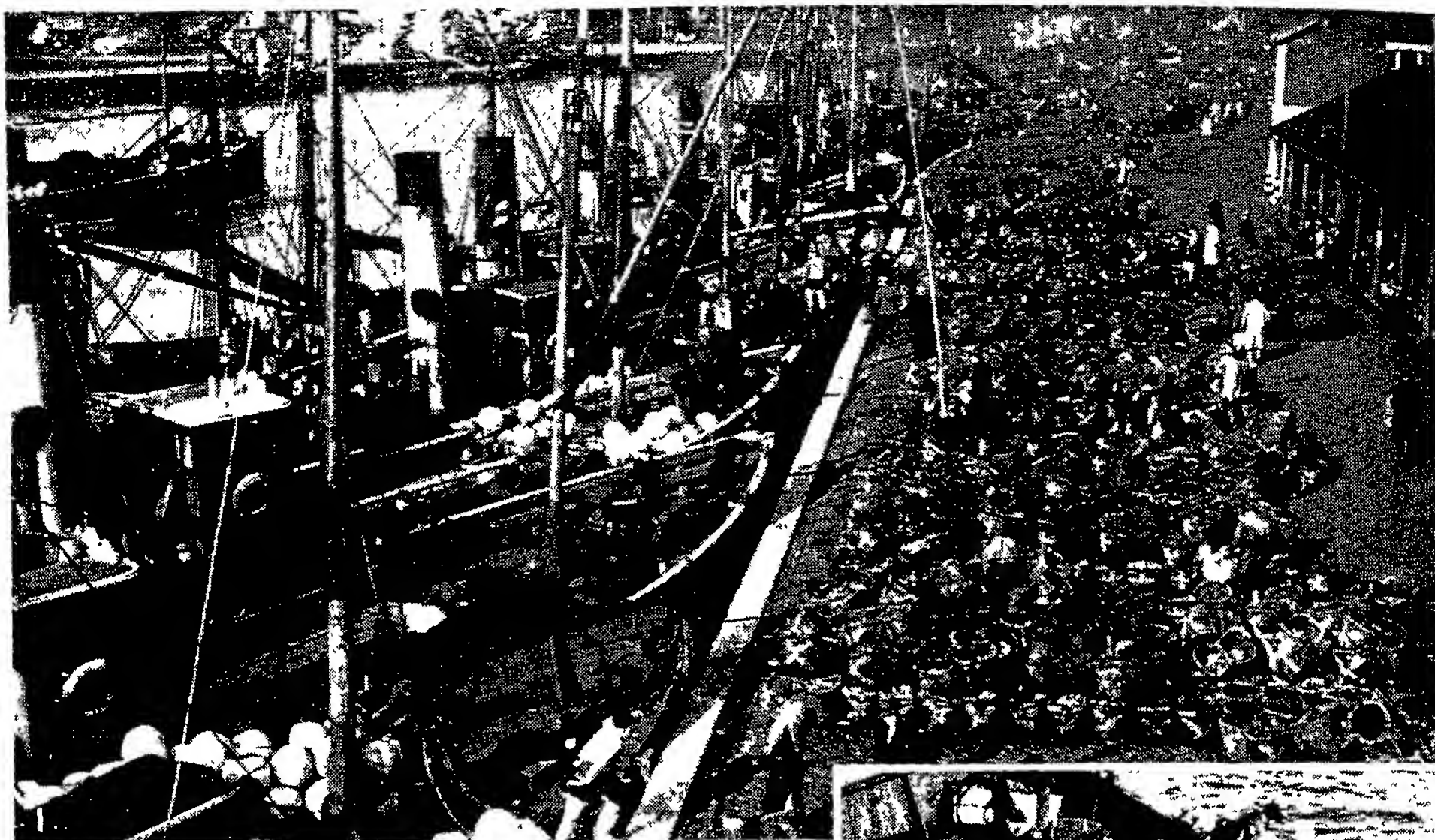
Fischer. Name of several German scientists. Emil (1852-1919), born Oct. 9, 1852, was awarded the Nobel prize for chemistry in 1902. His main work was in the preparation of synthetic sugars and research into problems of fermentation; he discovered the soporific veronal; his attention to nitrogen compounds was given at a time when German sources of munitions were failing. Eugen, born June 5, 1874, was professor of anthropology, Berlin, and director of the Kaiser Wilhelm Institute for anthropology and eugenics there 1927-42. Franz (1877-1947) was



1. *Peristedion cataphractum*, European seas. 2. *Dactylopterus volitans*, Mediterranean and tropical Atlantic. 3. *Holacanthus ciliaris*, Atlantic coasts of tropical America. 4. *Gomphosus coeruleus*, Indian Ocean. 5. *Cirrhitus cinctus*, Indian Ocean and West Pacific. 6. *Acanthurus velifer*, Polynesia. 7. *Heniochus macrolepidotus*, Indian Ocean and Malay Archipelago. 8. *Balistes aculeatus*, tropical seas. 9. *Holacanthus annulatus*, Malay Archipelago. 10. *Holacanthus asfur*, Red Sea. 11. *Pterois miles*, Red Sea and Indian Ocean. 12. *Amphiprion chrysogaster*, Indian Ocean. 13. *Balistes conspicillum*, Indian and Pacific Oceans. 14. *Julis trilobata*, and 15. *Coris aygula*, Red Sea, Indian and West Pacific Oceans. 16. *Cyprinus auratus*, China Sea. 17. *Epibulus insidiator*, Indian Ocean and Malay Archipelago.

FISH: VIVIDLY COLOURED SPECIES. HABITANTS OF MANY SEAS

Specially drawn, to approximately one-sixth natural size, by J. F. Campbell



1. Fishing fleet at the quayside, Yarmouth, showing carrier baskets used in unloading the boats. 2. East Anglian fishermen casting their nets. 3. Hauling a

catch of herrings aboard a drifter. 4. Unloading a fish carrier at the quay. 5. Packing fish for distribution to the various home markets. See text pp. 3381-4

FISHERIES: ACTIVITIES IN THE WORK OF THE NORTH SEA FISHING FLEET

part-inventor of the Fischer-Tropsch process (*q.v.*). Hans (1886-1945) was professor of chemistry at Innsbruck, Vienna, and Munich, and on being the first to prepare haemoglobin synthetically was awarded the Nobel prize for chemistry in 1930.

Fischer, JOHANN GEORG VON (1816-97). A German poet and dramatist. He was born Oct. 25, 1816, at Gross-Süssen, Württemberg. Having studied botany and literature at Tübingen, he was in 1846 appointed professor at the Stuttgart Oberrealschule. In 1854 he published his first volume of poems, and in 1896 his last, *Mit Achtzig Jahren* (In my Eightieth Year). He also published some dramas, notably *Saul*, 1862; and *Kaiser Maximilian von Mexiko*, 1868. His lyric poetry is characterised by natural beauty and exalted tone. He died at Stuttgart, May 4, 1897.

Fischer, KUNO (1824-1907). German philosophical writer. Born at Sandewalde, Silesia, July 23, 1824, after studying at Leipzig and Halle he became a tutor at Heidelberg, but owing to his advanced ideas was compelled to discontinue his lectures. For 16 years he was professor at Jena, and in 1872 succeeded Zeller as professor of philosophy at Heidelberg, where he died, July 4, 1907. A modified Hegelian in his views, he did much to popularise Kant. His greatest work, *History of Modern Philosophy* (latest ed. 1897-1904), is distinguished by lucidity and brilliancy of style and by wide knowledge.

Fischer-Tropsch Process. A method for synthesising hydrocarbon oils and waxes from the gases hydrogen and carbon monoxide, prepared from coal, coke, lignite, methane (natural gas), etc. Invented in Germany by Franz Fischer and Hans Tropsch in 1925, it was intensively developed in that country to produce synthetic liquid fuels. During 1939-45 nine Fischer-Tropsch plants with a total annual output of about 500,000 tons of synthetic oil were in operation in Germany.

In the process, coal, etc., is converted into a gas mixture containing one part of carbon monoxide to two parts hydrogen by treatment at high temperatures (180°-200° C.) with air (or oxygen) and steam. The gas mixture is purified from sulphur compounds and passed at a pressure of one to ten atmospheres through specially-designed reaction vessels containing a catalyst (*q.v.*) of which

cobalt is the most important constituent. After two or three stages of catalytic treatment, 80 p.c. of the reacting gases is converted to the desired products, which are recovered from the gas stream by cooling and absorption processes. The products, almost exclusively straight-chain paraffin and olefine hydrocarbons, are separated by distillation into the following fractions: Compressed liquefied gas, 10-15 p.c. by weight; motor spirit, 30-50 p.c.; diesel oil, 25-35 p.c.; wax, 10-25 p.c.

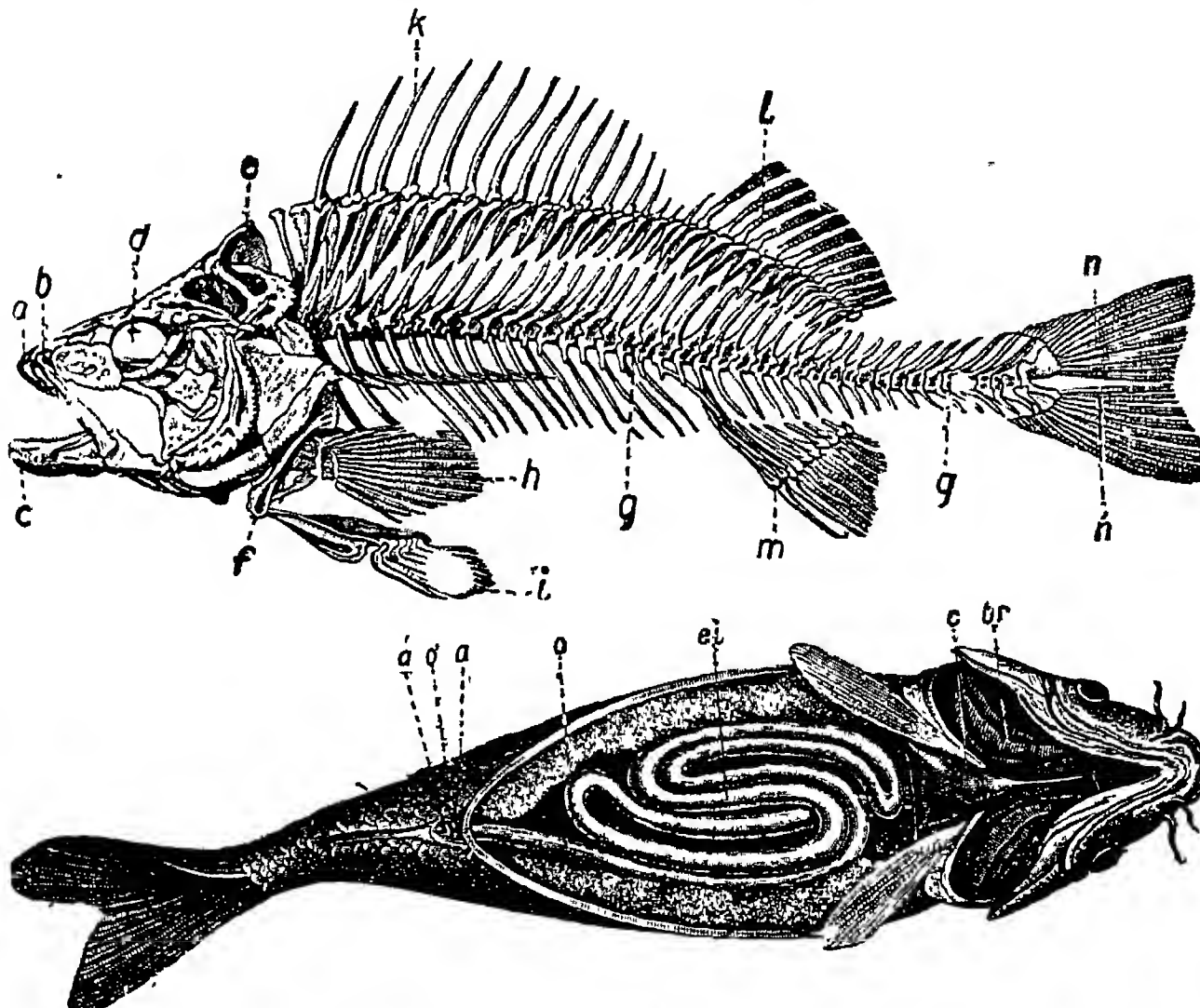
The compressed gas (propane, butane, propylene, and butylene) is used as portable fuel or as raw material for the manufacture of chemicals. The motor spirit (octane number, motor, 50) must be blended with higher grade fuel or extensively reformed to make it suitable for modern petrol engines. The Diesel oil (cetane number 78) is of exceptionally high quality and best used in admixture with low grade oils. The wax can be used in polishes, for electrical insulation, paper impregnation, etc. By further chemical treatment of the above primary products, high grade lubricating oils, soap, edible fat, and detergents can be prepared. See Hydrogenation; Low Temperature Carbonisation.

Fiscus. Latin word, meaning a purse, which came to be applied to the treasury of the emperor in ancient Rome, as opposed to the aerarium (*q.v.*), the treasury con-

trolled by the senate. As the power of the latter declined, the fiscus gradually became the state treasury for the whole empire, the functions of the aerarium being ultimately limited to the municipal finances of Rome.

Fiset, SIR EUGENE MARIE JOSEPH (1874-1951). Canadian surgeon and administrator. Born at Rimouski, March 15, 1874, and educated at Rimouski and Laval University, he completed his medical training in London and Paris. Fiset served with the Canadian contingent in S. Africa, being made colonel in 1903. Until 1906 he was director-general of medical services, and was then deputy-minister of militia and defence until 1923. He had much to do with equipping Canadian forces for the First Great War. In 1917 he was knighted. M.P. for Rimouski from 1924, lieut.-governor of Quebec 1939-50, he died June 8, 1951.

Fish. One of the classes or kingdoms of the animal world. Fishes may be defined as cold-blooded vertebrate animals, living in water, and breathing by means of gills. In a few a primitive lung is present, and the fish can breathe air directly. The limbs, when present, are paired fins; there are also unpaired fins which consist of folds or outgrowths of the skin. The body generally tapers towards the extremities, and is specially adapted for rapid passage through the water with the minimum of



Fish. Diagrams illustrating the structure of fishes. Upper, skeleton of common perch; a, pre-maxillary bone; b, maxillary bone; c, under jaw; d, palatine arch; e, cranium; f, inter-operculum; g, g', vertebral column; h, pectoral fin; i, ventral fin; k, l, dorsal fins; m, anal fin; n, n', caudal fin. Lower, internal anatomy of carp; br, branchiae or gills; c, heart; ei, intestinal canal; o, ovaries; a, a', anus; o', oviduct

resistance. Sometimes the body is greatly flattened—either vertically, as in the rays, or laterally, as in the sole and turbot. In nearly all the genera the heart has two chambers and contains venous blood only. With few exceptions fishes reproduce their kind by eggs which are deposited in the water and fertilised by the male after they leave the body of the female, though a few species bring forth living young.

Fishes are found in all waters, both marine and fresh, and at almost all temperatures. Something like 2,300 species of fresh-water fishes are known to science; about 3,500 species are littoral; many others inhabit the seas far from land; and about 100 genera, including numerous species, have been met with in the lowest depths of the ocean.

Functions of the Fins

The skeletons of fishes are usually bony; but in the Elasmobranchs they are cartilaginous in character. In addition to the skeleton supporting the body outline and the limbs, there are often numerous bony rays supporting the unpaired fins also. The tail, with the caudal fin, is the principal propelling instrument, the paired fins being used as auxiliaries and for steering. The unpaired fins on the dorsal and ventral sides of the body serve mainly as balancers. The scales with which the body is more or less covered are sometimes bony. They are often nearly allied to teeth in structure and contain dentine.

Fishes breathe by extracting the oxygen contained in water, which is usually taken in by the mouth and passed out through the gill-clefts on either side at the hinder part of the head. In its course it passes over a series of arches or plates, abundantly supplied with blood-vessels, and the oxygen is thus brought into contact with the blood much as in the lungs of terrestrial animals. Most fishes are well supplied with teeth, which in some families are numerous. They may be confined to the edges of the jaws, but are often found on the palate and even on the gill arches and in the throat. There may be both cutting teeth and grinding ones, the latter often taking the form of plates. They usually grow to join the surfaces of the bones of the mouth, but are sometimes found in sockets. They are usually replaced, when worn down, by fresh teeth.

Fishes have in most species well-developed eyes, and their power of

vision is good. A few genera, found in underground streams or in the greatest depths of the ocean, are without functional eyes. Experiment proves that most species can hear well; and their sense of touch is highly developed, the barbels which are found around the mouth in many species being used for this purpose. Whether the sense of taste is as well developed is less certain. In colour fishes vary greatly, from the most sombre tones to the most brilliant hues. As a rule, the upper surface is darker than the lower, an arrangement which helps to make them inconspicuous. Protective coloration is often present, notably in the flat fish, which often so exactly resemble the mud and sand that they are very difficult to see when lying on the bottom. Many species, especially in the tropics, are gorgeously coloured and variegated to match the seaweeds and corals of their environment.

In the matter of diet fishes vary greatly, and almost everything, both animal and vegetable, that lives in the water is preyed upon by one species or another. Small crustaceans and molluscs form the most important item in the food of most fishes; but many prey on smaller fishes, and others browse on the aquatic vegetation. Some swallow mud and extract nutriment from it. As a rule, the appetite of fishes is large, and some species have such expansive powers that they will even swallow other fishes larger than themselves. Nearly all fishes are edible, though many are coarse and indigestible and a few appear to be actually poisonous. But the poor reputation of certain species is simply due to unskilful and unsuitable cooking. Fresh-water fishes, with the exception of salmon and trout, are as a rule of muddy or insipid flavour compared with the marine fishes.

Divisions of Fish Kingdom

The class Pisces—the fishes—is usually divided into two great grades: cartilaginous fishes and bony fishes. In the former group are included the sharks and rays together with a number of extinct species and the curious Chimaera. In the bony fishes are included the lung fishes, the Crossopterygians which were believed all to be extinct until one was caught alive off South Africa in 1938 and named *Latimeria*, and all the familiar living forms. The Holostei, the group to which the familiar forms mostly belong, though now extremely widely distributed in the

oceans of the world, where they are enormously plentiful, are probably derived from fresh-water forms which have secondarily invaded the sea, displacing the many salt-water forms which flourished in past ages.

Bibliography. The Migrations of Fish, A. Meek, 1916; The Biology of Fishes, H. M. Kyle, 1926; A History of Fishes, J. R. Norman, 1931; The Fishes of the British Isles, J. T. Jenkins, 1942; The Fish Gate, M. Graham, 1943.

Fish, HAMILTON (1808–93). An American statesman. Born Aug. 3, 1808, in New York, he became a barrister in 1830. In 1842, as a Whig, he was returned to congress, and in 1848 he became governor of New York state. In 1851 he was elected a senator. After visiting Europe, he took a prominent part in the election of Lincoln. Organizing many schemes for the assistance of troops during the Civil War, Fish was also largely responsible for relief measures for the war prisoners. During 1869–77 he was a secretary of state under Grant. One of the commissioners for the treaty of Washington, he was identified with many negotiations which improved the relations between the U.K. and the U.S.A. He died in New York Sept. 6, 1893.

Fish Culture. Increasing by artificial means stocks of fish for profit or pleasure. This ancient art takes many forms: breeding, feeding, aiding normal migrations, transplantation, introduction of new species, destruction of or protection against enemies. It is pursued with varying vigour in different parts of the world for widely different human needs. Nearly always it is fresh (sometimes brackish) water fishes which are concerned. A limited number of sea fish hatcheries are in operation, but so little is known of the causes of the immense natural fluctuations and of the conditions affecting the larval and post-larval stages of fish in the sea, that, even when astronomical numbers of eggs are handled, contributions by human effort can be of little significance.

When the fish can be controlled in ponds, lakes, and rivers, in almost every civilized country the state takes a hand proportional to national needs. Over fifty years a substantial literature has come into existence on the technique of fish culture. To the Chinese must be attributed the largest experience of an art probably stereotyped in China 1,000 years before the Christian era. A French writer has described the sight of

80 junks awaiting cargoes of fry for distribution, the average value of each cargo being £5,000. The valuable species readily cultivated are the carp, eel, and trout. In Germany, especially, the routine of draining and cultivating the bed of carp ponds is understood. There has long been a considerable trade in young eels for ponds and lakes. Early in the 20th century the German government, profiting by the new discoveries concerning the life history of the eel, established an elver collecting station on the Severn at Epney, whence during 1908-14 38,000,000 elvers were shipped to Germany via Grimsby.

Denmark has developed the culture of trout for food. Starting about 1890, some 100 trout farms in Jutland handle the fast-growing rainbow trout. Streamside ponds are constructed and the fish are fed on readily obtained sea fish refuse. The trout are sold when at a size suitable for serving singly in restaurants. From 1931 to 1936 the export averaged 628 tons annually, about one third being shipped to England. Over the same period 72,000,000 trout eggs were sold abroad, chiefly to Switzerland, France, and Belgium.

In Great Britain, where access to fish supplies from the sea is easy, the taste for fresh water species is both limited and local. The score or so fish farms in existence devote attention chiefly to trout. Results with salmon have not been convincing, but attention is given to the control of netting and pollution and the construction of fish passes to enable fish to reach their natural spawning areas. Success has attended the introduction of salmon and trout to New Zealand; while in the U.S.A. the cultivation of Pacific salmon is regularly undertaken.

In 1941, of the 5,878,000,000 eggs and fry of 45 different species handled, salmon and trout of eleven species were the principal group covered. In many parts of the world mountain streams have been populated by trout.

The service of aircraft has made possible the planting of fish in areas which might otherwise be inaccessible. A striking example of successful introduction of a new commercial fish to an area where it was unknown is afforded by the experience of the U.S. fish commission with the shad. In 1871 shad fry from the Hudson on the Atlantic coast were set out in the Sacramento flowing into

the Pacific. The young fish migrated to sea and the reappearance of mature fish ascending to spawn a few years later gave indications of the success of the experiment. The fish has now spread to rivers along 3,000 miles of coastline from California to Alaska. Experiments in northern waters with the plaice have demonstrated that this species can be transplanted from areas where it grows slowly to others where growth is rapid. The Danish government in cooperation with fishermen has engaged in a regular profitable business. The fish are carried in well vessels from the Jutland coast to the inner salt water broads. English authorities have carried similar small plaice from the nursery grounds on the Danish and Dutch coasts to the Dogger Bank, where the increase in growth has been found to be 300 or 400 p.c. The cultivation of certain shellfish, mussels in particular, has been practised with success for many years. Oysters can be relaid in areas suited to their growth; the experimental station at Conway has reared oysters up to the stage when they can be set out on the growing beds.

George T. Atkinson

Fish Curing. Term for various methods of preserving fish. The drying, pickling, smoking, or other curing of fish especially in times of abundance against periods of scarcity, is of great antiquity. Improvement in transport, development of cold storage and refrigeration, and of canning have gone far to reduce demand for the cured fish on which, until a few generations ago, man was partly dependent for maintaining his winter protein food stocks. However, in some places, by reason of the seasonal assembly of fish shoals, such as the autumn herring off Yarmouth, or the location of a far ranging fishing fleet such as that at Hull, Grimsby, or Aberdeen, extensive industries for the preparation of cured fish still operate.

Two types of fish are best suited for curing: the cod family, in which the fat is concentrated in the liver, can be salted and dried in the sun or by artificial heat; the herring family, on the other hand, with its fat dispersed through the body tissues, needs preservation in salt solution or by salting and smoking. In the former category, besides the cod itself there are the haddock, coal-fish, ling, whiting, and tusk. In the herring type are included

herring, pilchard, and sprat, and the shad and the anchovy.

HERRING. In Europe the herring outweighs all others in the commerce of cured fish. Long experience has taught not only the seasons of the coming of the shoals but also the periods of optimum condition for curing. For lighter cures for immediate use, *e.g.* kippers and bloaters, this is not of such importance as for the pickle cure in barrels. For instance, winter herrings, owing to their high water and low fat content, pine or shrink excessively in the salt solution. Early summer fish by reason of rich feeding tend to disintegrate in the barrel. The presence of milt or roe is also judged of great importance. The second half of the year furnishes the most satisfactory herrings for curing in barrels, marketed mainly along the Baltic seaboard; while fish most suitable for smoking for the centuries-old trade with the Mediterranean are those caught in Oct. and Nov.

Herrings for pickle curing are sprinkled with salt as soon as possible after discharge from the fishing vessel. At the curing yard they are again sprinkled in the farlanes or gutting troughs. From these, specially trained women, who follow the fishery along the coast, gut and pack. Each fish is seized with the left hand, and a deft movement with the short gutting knife held in the right hand removes in one operation the gills and gut: the milt or roe remains. Not only are the fish gutted at as high a rate as twenty in a minute, but they are also selected into the various trade categories for packing in separate barrels. The women work in crews of three, two gutting and one packing, their remuneration being by weekly wage plus an agreed amount for each barrel packed. It being found increasingly difficult to attract women to this work, experiments were begun with herring gutting machinery. Power-driven machines were also introduced for splitting herrings for kippers.

The packing of gutted herrings is done in orderly tiers, a layer of herring, a layer of salt, a layer of herring, and so on. Pickling begins immediately, the salt being dissolved by the natural juices of the herring. The room left in the barrel by the shrinking of the fish in this process is filled after a few days with other fish of the same cure. A hole is also bored in the bilge of the barrel, the pickle is

run off, and the space filled with more herrings; the barrel head is replaced and the pickle poured back through the bored hole, which is then closed with a bung. Stencilled on the end with the trade mark of the curer and the category of the contents, the barrel is ready for shipment or storage. Under certain strict conditions barrels of herrings receive a government brand.

Decline of the Trade

The changed face of Europe after the First Great War found the British herring industry deprived of its best customer, Russia; Germany and other countries on the Baltic were unable to purchase herrings to the extent they had done during the first decade of the century. Compared with an export of 8½ million cwt. in 1913, the average had fallen by the period 1933-1938 to under 2½ million cwt. A subsidy in 1919 and 1920 gave temporary stimulus, but successive crises led to legislation by which, under the Herring Industry Acts 1935 and 1938, the herring industry board was set up to reorganize, develop, and regulate the industry. For the period of the Second Great War, the board did not function, and matters affecting the herring came chiefly under the control of the ministry of Food. Recovery after the war of former markets in the Baltic Countries was slow.

Bismarck herrings and rollmops are pickled herrings further treated with white wine vinegar. Smoked herrings for export are cured almost exclusively in Yarmouth. Here, previous to a long period of smoking, suitable herrings are salted and stored in concrete vats. Export is principally to Italy and Greece.

The pilchard, rarely appearing in marketable quantities except off Cornwall, is by its perishable nature of little use except for curing. Salted and pressed in barrels, it is marketed in Italy. The catch fluctuates considerably and varied between 1,100 and 6,600 tons annually in the eleven years preceding the Second Great War.

Only at the time of its autumn migration to the coast is the sprat taken commercially. It lends itself readily to many curing processes. For immediate use it can be lightly salted and bloatered or, by more intensive treatment with smoke, "redded." Both these are cold smoking methods. In special ovens the fish can be treated with hot smoke from hard wood chips, creating in a confined

space the highly prized *Kieler Spratten*. Specially prepared sprat pickled with salt in barrels and with sugar and spices is in demand in Sweden, U.S.A., and S. Africa. The sprat catch in the eleven years before the Second Great War varied between 2,300 and 6,800 tons.

Mackerel is seldom cured in Great Britain; in some years Scandinavian vessels visit Scottish ports to cure in barrels mackerel taken in the nets of British fishermen in the course of summer fishing.

Cod. There is a demand for salted fish of the cod type in the Mediterranean countries, South America, and the W. Indies. Protective tariffs, fluctuating exchanges, movements towards self-sufficiency and improved fishing technique with up-to-date craft in the northern nations from off whose shores British trawlers had to bring their catches (Iceland, the Faroes, Norway), limited the development of British fish curing. The average annual exports of salt cod and haddock from Great Britain for the pre-war decade were 269,000 and 15,000 cwt. respectively. Other species are not separately distinguished in official statistics. Consult *The Art of Fish Curing*, R. S. Duthie, 1911; brochures of the Torry station of the department of Scientific and Industrial Research.

George T. Atkinson

Fisher, JOHN ARBUTHNOT FISHER, 1ST BARON (1841-1920). A British sailor. He was born



Russell

Jan. 25, 1841, at Rambodde, Ceylon. He entered the Royal Navy in 1854, and served in the Calcutta with the Baltic Fleet during the Crimean war. He was present at the capture of Canton in 1857 and the attack on the Peiho ports. He commanded the *Inflexible* at the bombardment of Alexandria in 1882, and later landed with the naval brigade, when he organized an armoured train. In 1899 he became c.-in.-c. in the Mediterranean.

Second sea lord at the Admiralty in 1902, Fisher was largely responsible for establishing the naval cadet colleges at Osborne and Dartmouth, which replaced the training ship *Britannia*. As first sea lord, 1904-10, he directed

great changes in naval organization, ships, and weapons, spurred on mainly by the competitive and rapid expansion of German naval power. He introduced the dreadnought and sponsored the development of oil fuel and submarines in the Royal Navy. He was made a peer in 1909. Upon the resignation of the marquess of Milford Haven in Oct., 1914, Fisher returned to the Admiralty as first sea lord.

There he energetically prosecuted the war at sea, and the decisive victory in the battle of the Falkland Islands (*q.v.*) on Dec. 8 was entirely due to his action in sending two battle cruisers secretly from the North Sea despite the opposition of the commanders in home waters. He strongly opposed the Dardanelles expedition, and in May, 1915, shortly after the offensive had been launched, resigned, maintaining that ships required by the Grand Fleet in the North Sea were being imperilled. Though publicly censured by the Dardanelles committee, he refused to defend himself. In 1919-20 he wrote letters to *The Times* criticising the conduct of naval operations during the war, notable for the refrain "sack the lot"; and in 1919 published his memoirs. He died July 10, 1920, being succeeded by his son Cecil Vavasour Fisher (1868-1955). Consult *Life. Adm. Sir R. H. Bacon*, new ed. 1942; *Fear God and Dread Nought* (letters), 2 vols., 1952 and 1956.

Fisher, ANDREW (1862-1928). Australian politician. Born Aug. 29, 1862, at Kilmarnock, Scotland, he at first worked in the coal mines. In 1885 he emigrated to Queensland and in 1893 was elected to its legislature. Fisher entered the Commonwealth parliament as M.P. for Wide Bay in 1900. In 1904 he became minister of trade and customs, and in 1907 leader of the Labour party. He was thrice prime minister and during his administration of 1910-13 founded the Commonwealth Bank and began to build Canberra. He was high commissioner in England, 1915-21. He died Oct. 28, 1928.

Fisher, GEOFFREY FRANCIS (b. 1887). British ecclesiastic. Born May 5, 1887, he was educated at Marlborough and Exeter College, Oxford. An assistant master at Marlborough, 1911-14, he was ordained 1912, and was headmaster of Repton, 1914-32. Bishop of Chester in 1932, and transferred to London in 1939, he was appointed archbishop of Canterbury in succession to William Temple

in January, 1945, his enthronement taking place on April 19. For portrait see Archbishop.

Fisher, HERBERT ALBERT LAURENS (1865–1940). British historian and educationist. Born



H. A. L. Fisher,
British historian

in London, March 21, 1865, he was educated at Winchester and New College, Oxford. As lecturer and tutor in history he remained at Oxford until 1912,

when he became vice-chancellor of Sheffield university, a position he held until 1916. As president of the board of education in Lloyd George's cabinet, 1916–22, he was responsible for the comprehensive Education Act of 1918, providing a system of continuation schools and securing improved conditions for teaching. Warden of New College from 1925, he was a leading historian, his *History of Europe*, 1935, becoming a standard work. Other publications included *The Medieval Empire*, 1898; *Political History of England, 1485–1558*, 1906; *Life of Lord Bryce*, 1926. Fisher received the O.M. 1937. He died in London as the result of an accident, April 18 1940.

Fisher, IRVING (1867–1947). U.S. economist. Born at Saugerties, N.Y., Feb. 27, 1867, he was educated at Yale, at which university he held a chair of political economy, 1898–1935. A member of many U.S. and foreign learned societies, he was a leading economist, and his numerous works, many translated into the chief European languages, included *The Nature of Capital and Income*, 1906; *How to Live*, 1915; *Stabilising the Dollar*, 1920; *The Money Illusion*, 1928; *The Noble Experiment*, 1930; *Booms and Depressions*, 1932; *Stable Money*, 1934; *World Maps and Globes*, 1944. He died April 23, 1947.

Fisher, JOHN (c. 1459–1535). English prelate and saint. Born at Beverley, he was educated at Cambridge, becoming master of Michail House in 1497 and chancellor of the university in 1504. In 1497 he had been appointed confessor to Henry VII's mother, Margaret,



John Fisher,
English prelate
After Holbein

countess of Richmond, and in 1503 became the first Lady Margaret professor of divinity. In 1504 he was made bishop of Rochester. He was a keen opponent of Henry VIII's divorce from Catherine of Aragon, was imprisoned in the Tower in 1534 for refusing to swear to the Act of Succession, and on June 22, 1535, was beheaded on Tower Hill for refusing to recognize Henry as supreme head of the Church. He had been created a cardinal on May 20. A zealous humanist, he was instrumental in bringing Erasmus to Cambridge. He was beatified on Dec. 9, 1886; and on the 400th anniversary of his death, 1935, he was canonised as S. John of Rochester. His festival is on June 22. A *Life* by N. M. Wilby appeared in 1929.

Fisher, SIR (NORMAN FENWICK) WARREN (1879–1948). British civil servant. Born Sept. 22, 1879, he was educated at Winchester and Hertford College, Oxford. He was private secretary to Sir Robert Chalmers, 1908–10; a special commissioner of income tax, 1910–13; on the national health insurance commission, 1912–13; deputy chairman of the board of inland revenue, 1914–18; chairman, 1918–19. He then succeeded Sir John Bradbury as permanent secretary of the treasury, a position he held until 1939. His signature succeeded that of Bradbury on British currency notes. During the Second Great War Fisher became a special commissioner for civil defence in London, 1940–42. He died Sept. 25, 1948.

FISHERIES: A VITAL FOOD INDUSTRY

Further information will be found in the articles on various fishes used as food, e.g. Cod; Herring, etc.; on branches of the industry—Fish Curing; Trawling, etc.; and on the world's chief fishing grounds—Dogger Bank; White Sea, etc. See illus. facing p. 3377.

In its widest sense, the term fisheries includes the taking of all kinds of water products and embraces the hunting of whales, seals, and other aquatic mammals, the taking of shrimps, crabs, lobsters, turtles, and alligators, and the gathering of pearls, sponges, and coral. In its more general application, however, the term is restricted to the taking of fish by line, net, or trawl.

Fishing, the earliest form of hunting, provided ancient man with his first flesh food, and trading in fish was one of the earliest forms of commerce. Specially built ponds have been found in which the ancient Egyptian and Chinese kept netted fish alive until they were purchased. The Romans maintained a large and profitable trade in lampreys and eels between the seaboard cities of Italy and the most distant parts of their empire, and fish was imported into Rome from places as far distant as the Caspian Sea. Until medieval times the Mediterranean was the principal fishing ground of the civilized world, but in the 17th century the European centre of the fishing industry moved to the N. countries, notably Britain, France, Norway, and Germany. Until the development of refrigeration in the 1880s, the consumption of fresh deep-sea fish was confined to coastal districts, and inland centres were restricted to salted fish or the limited supply of fresh water fish.

Salt water fish are classified as pelagic and demersal. The former

group includes mackerel, herring, and a few other species which spend the greater part of their lives in mid-water, anywhere between the sea-bed and surface, according to their feeding and spawning habits. The great majority of edible fish fall in the demersal class (bottom fish), and with few exceptions they spend the greater part of their existence on or near the sea-beds. Although a few species of demersal fish come inshore for spawning or feeding, most of them spawn in the open sea, and shoals move over vast areas of water, either by swimming or with the aid of ocean currents. Cod, haddock, halibut, saithe, plaice, and other deep-sea fish feed very close to the bottom, where light, temperature, and movement are but little felt. Fast swimming fish, such as dog-fish and hake, come near the surface in search of food, but they rest and spawn on the sea-bed, and it is there that they are caught. Hake is essentially a deep-water fish and is normally caught at a depth of 350 fathoms, while cod is caught in bulk only on the fringe of the icefields in the Arctic circle. Of the demersal fishes cod is the most important, providing about half of the weight taken; among the pelagic, the herring predominates.

In normal times the most important European fisheries are those of Norway, and before the Second Great War Norwegian fishing fleets landed a total annual catch worth £10,000,000, mostly

cod and herring. The chief fisheries of Belgium are of the inshore variety, and the shore fishing catch of France includes herring, mackerel, sardines, anchovies, and sprats. Germany has an extensive deep-sea and inshore fishing industry, the principal catches being cod, haddock, whiting, plaice, lemon sole, ling, and herring, which are landed at the North Sea and Baltic ports. Dutch fishing fleets are mainly concerned with the catching of flatfish, eels, herrings, and cod, which are marketed on the Continent and in Great Britain. Of the produce of the Portuguese, Spanish, and Italian fisheries, more than half is sardines.

In the western hemisphere are the great fisheries of N. America, extending from Labrador to Massachusetts. Seven years after Cabot discovered Newfoundland and reported upon its rich cod fisheries, France sent over her fishing fleets and paid bounties to encourage the industry. Other nations soon followed, and the Newfoundland cod fisheries have been responsible for more than one war between European powers. Icelandic waters rival the Newfoundland banks for cod, and also yield great catches of haddock, ling, and halibut. By the use of ocean-going trawlers equipped with refrigerators, the British exploit the Iceland fisheries and have also developed extensive fisheries in the White Sea and the waters round Bear Island, far within the Arctic Circle.

Importance of the Herring

By far the most important fish commercially is the herring, and the largest catches are made by the fishing fleets of Norway, Sweden, France, and Great Britain, while this fishery is growing rapidly in Canada; herring constitutes 25 p.c. of the yield of all European fisheries.

Nearly every country with a seaboard has a fishing industry of some kind, and the West Indies, Australia, and New Zealand have developed a considerable export trade from their fisheries. China, Japan, India, Pakistan, and Russia have large fishing industries, but the greater part of their catches is absorbed by home markets. Japanese fishing fleets operate on both shores of the Pacific Ocean.

Of fresh water fish the most important is the salmon. The salmon of the American Pacific coast are caught when they are entering the streams from the ocean to spawn. Both Canada and the U.S.A. have a vast export trade in canned sal-

mon. Fresh water fish such as carp are bred in central Europe, and various species of trout are raised in the hatcheries of Great Britain and the U.S.A.

Demersal fish are taken as to 97 p.c. by a net dragged over the seabed (trawl or Danish seine). Lines

creasing extent by the proportion of the catch derived from the Arctic seas. At one time the landing of large quantities of low-grade fish depressed prices, and by mutual agreement the industry had to regulate production by the Sea Fishing Industry Act,



Fisheries. Herring drifters trailing their nets in the North Sea

to a limited extent in most European countries, except Norway, Iceland, and the Faroes, are used for both classes of fish. Trawling in the North Sea began on a large scale only about a century ago. Before the 1880s sail predominated. Trawlers visited the waters off Iceland in 1891, N. Russia in 1905, Spain and Morocco in 1906, and Newfoundland in 1911. From 1895, when the otter trawl replaced the beam trawl of the sail and early steam trawler, the capacity and efficiency of fishing gear were increased in many ways; greater depths and areas formerly considered unsuitable for trawling were explored and charted. In 1938 the British steam trawler fleet numbered about 1,400 vessels, of which 1,153 had their home ports in England and Wales; the British offshore fleet in 1956 numbered 250 deep-sea trawlers, 250 motor drifters, and 100 ring net vessels.

Of some 4½ million tons of fish landed annually in W. Europe, Norway, and Great Britain are each responsible for about one quarter. Next in order with 450,000 tons comes Germany, then France (275,000 tons), Iceland (261,000 tons), the Netherlands (160,000 tons), Sweden (110,000 tons), and Denmark (84,000 tons). Germany's special effort is towards supplying her own extensive need for herrings.

BRITISH FISHERIES. The level of supplies of fish landed in the U.K. for the home market shows little variation from year to year, and has been maintained to an in-

1933. This enforced a close season in certain N. waters during the summer. The changes which took place in ten years in the proportion of North Sea fish to that from the N. seas are indicated by the fact that, whereas between 1928 and 1938 the North Sea catch of demersal fish declined from 2,866,000 cwt. to 1,658,000 cwt., that from the principal northern fisheries rose from 3,763,000 cwt. to 8,427,000 cwt. Inshore fishing boats in Great Britain in 1956 numbered 6,000; their contribution to the whole covers the most valuable fishes—salmon, trout, eels, and shellfish, including molluscs (oysters, mussels, cockles, crabs, lobsters, crayfish)—and pilchards and sprats.

In 1913 there were 15,000 vessels of all types manned by 80,000 men and boys engaged in the fishing fleets of Great Britain. Immediately following the First Great War, the industry suffered a serious decline in the face of subsidised foreign competition, and a system of quotas was established, but, although fishing revived considerably in the years immediately preceding the Second Great War, in 1938 it was little more than 70 p.c. of the figures for 1913; the number of vessels of all types had been reduced to 13,700 and the number of men employed as crews had declined to 56,000. In 1955 the numbers had sunk to 25,136 men in regular, and 3,186 men in occasional employment as fishermen.

The plight of the once prosperous herring industry was the

major cause of the decline in the British industry. The control of herring affairs now falls to the herring industry board. It owes its origin to the first inquiries instituted by the sea fish commission appointed to recommend remedies for the depression which came over the herring industry in the world slump of the 1930s. Over a twenty-year period the export of herrings had fallen by 55 p.c. and home consumption by 45 p.c. The steam drifter fleet from which comes 80 p.c. of the herring catch decreased from 1,500 vessels in 1913 to 1,088 in 1933. The herring board found it necessary to reduce the fleet still further, and, by 1938 only 685 steam drifters remained. The contraction can be ascribed to the First Great War, which lost Britain her principal customers. In 1911-13 the average number of barrels exported to Germany, Russia, and the Baltic states was 2,424,000; in 1933 it was only 727,000 barrels. Parallel with this shrinkage, policies of self-sufficiency were developing: Germany's production increased from 251,000 in 1929 to 1,059,000 in 1937, and her volume of trawled herrings grew from 56,000 tons in 1930 to 163,000 in 1937; herring production on the N. Russian coast grew from 1,000 tons in 1930 to 99,000 tons in 1935. Further measures taken by the herring board aimed at tightening control over the quality of herrings exported, regulating the number of the nets and the areas fished, financing the purchase of fishing gear and the repair of vessels, and aiding research. The herring industry board resumed its work in 1946 after a wartime standstill. In 1956 British drifters landed 176,000 tons of herrings at U.K. ports, of which about one-third was exported.

Fisheries Convention for Europe

In the closing years of the 19th century, alarm was expressed in more than one country at the decline in the fish population, especially of the flatfish. Discussions led to the formation of the international council for the exploration of the sea, with headquarters at Copenhagen. An elaborate programme of research, interrupted by the First Great War, covering all matters affecting the sea and its inhabitants was entered upon. The outcome was prospective international legislation for the rational exploitation of European fisheries. In 1937 a fisheries convention was signed by the governments of Great

Britain, Belgium, Denmark, Germany, Iceland, Eire, the Netherlands, and Sweden. Amongst other things, the convention regulated the sizes of the meshes of otter trawls and seine nets to be used by vessels of the signatory countries in certain waters of the E. Atlantic. But for the outbreak of war in 1939, the convention would have been extended to provide for the replenishment of the fish population in the North Sea and eastern N. Atlantic.

Experiments in Re-Stocking

Fishermen have done little towards conservation or planning for their future supplies. There are several sea fish hatcheries in Europe, but their work is experimental only and, in view of the as yet little understood causes of the great fluctuations in the abundance of natural brood, cannot be regarded as contributing much to the stock. Oyster breeding, on the other hand, after some years of experiment, appears to be a commercial possibility. In Denmark fishermen cooperate with the government in transplanting young plaice from the coast, where they grow slowly, to the inner part of the Lim Fjord, where the growth in a season is so increased as to make the undertaking worth while on a commercial scale. English experiments have shown that similar results can be obtained by conveying small plaice from the inshore nursery grounds to the rich feeding grounds on the Dogger Bank in the middle of the North Sea where no small plaice are normally found. Important experiments in the acceleration of flatfish growth by adding artificial fertilisers to the water have been made in Argyllshire lochs and elsewhere, but are not yet a commercial proposition.

Cooperation of scientists and fishermen has produced systems of finding fish shoals by two methods: one is the adaptation of echosounding, originally developed to locate submarines and other underwater objects; the other by rapid assessment of areas with an abundance of microscopic plankton on which fish such as the herring feed. It is also possible to forecast with some accuracy prospects of fish harvests some time ahead. This has been done for herring, haddock, and cod, and is based on a study of the age composition of the shoals in one year and calculating subsequent mortality.

THE SECOND GREAT WAR. At the outbreak of the war, control over the movements of British

fishing vessels passed to the Admiralty, and as a result of security measures and the laying of minefields fishing was restricted to the grounds around Iceland, off the W. coast of Scotland, in the Irish Sea, and off the W. coast of Ireland. Large numbers of fishing vessels also were requisitioned for naval purposes (*see Fishing Fleet*). The amount of fish available during the war always fell far short of the demand, therefore, and Great Britain was obliged to draw largely upon supplies of frozen, salted, and tinned fish from Newfoundland, Canada, Alaska, and California. Further, many distant and neutral countries embarked upon campaigns to exploit their natural fishery resources. New Zealand developed an important industry in the canning of mullet and ling fish, while Australia greatly increased the yield from its domestic fisheries and established a government controlling body for the more orderly marketing of fish. Most of the S. American republics developed fishing industries for domestic consumption to replace the interrupted imports of food from abroad, and also established canneries for the supply of fish to the belligerent countries.

Wartime Fluctuations

Throughout the first year of the war in Europe, the U.S.A. fisheries greatly increased their yield of all kinds of fish, the bulk of the surplus being exported to neutral and Allied countries in Europe. With America's entry into the war, however, the requisitioning of many of the fishing industry's vessels caused a big drop in yield. In 1941 American fishing boats landed 2,500,000 tons of fish, but the following year the yield dropped to under 2,000,000 tons. Very limited fishing activities were conducted by Germany and the Axis-dominated countries of Norway, Denmark, and Finland.

Fishing was rehabilitated in the liberated parts of Italy under Allied control, and, following the Allied invasion of Europe in 1944, the French, and later the Dutch and Belgian, fishing industries began to revive. The North Sea grounds, however, continued to be greatly hampered by minefields. In 1945 the world's fisheries yielded a total catch of 14,000,000 tons; but in many countries fish continued in short supply owing to the dislocation of transport and other trade channels.

Owing to the relaxation during the war of measures designed to

maintain the fish population, there was over-fishing of certain areas, causing some concern regarding the future. Accordingly, the United Nations interim commission on food and agriculture established a sub-committee on fisheries to advise the commission on the preparation of a plan for international cooperation in the development and proper use of the world's fishery resources.

Fisher's. Island of the U.S.A. Situated at the E. end of Long Island Sound, 3 m. off Connecticut, it forms a part of Suffolk co., New York. It is about 8 m. long by 1 m. broad. It is frequented as a summer resort, and the chief occupation is agriculture. The U.S. government maintains a military and naval reservation, Fort Wright. Pop. about 400.

Fishguard and Goodwick. Urban dist. seaport. and market town of Pembrokeshire, Wales. It stands on the Gwaun near its entrance into Fishguard Bay, 12½ m. N. of Haverfordwest. As the British Railways terminal port for Cork, Rosslare, and Waterford in the Irish Republic, it has an excellent harbour and breakwater



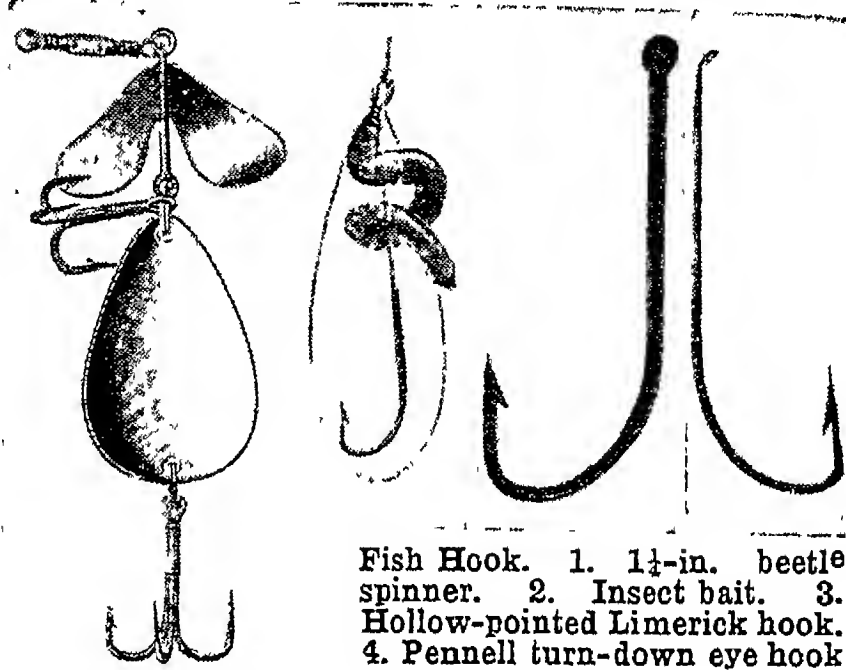
Fishguard. Bay of the Pembrokeshire port from which steamers cross daily to Ireland

(2,500 ft.), a coastguard and life-boat station, and a pier constructed by the G.W.R. in 1906. It is also a centre for sailing and angling. Market, Thurs. Pop. (1951) 4,839.

Fishguard was the site of the last "invasion" of Great Britain: in 1797 a French invading force of some 1,200 soldiers landed near the town, and eventually surrendered to the local yeomanry.

Fish Hook. Apparatus for catching fish. At first a flake of flint sharpened at both ends, with a thong attached to the centre, was employed for this purpose. But the antiquity of the metal hook is great, bronze fish hooks of modern shape having been found in lake-dwellings in Switzerland and elsewhere.

The modern fish hook is made of soft cast steel wire. The wire is cut into lengths and the barb formed



Fish Hook. 1. 1½-in. beetle spinner. 2. Insect bait. 3. Hollow-pointed Limerick hook. 4. Pennell turn-down eye hook

By courtesy of S. Allcock & Co.

and sharpened before the wire is bent into shape. The shanks are then ringed or flattened, and the hooks are hardened, tempered, and scoured. Machinery performs the various processes automatically. Hooks vary greatly in size and shape, from the huge hook with swivel and chain attachment used for catching sharks, down to the tiny-eyed hook on which the smallest trout flies are dressed.

Fishing. Art or practice of catching fish. It is divided into two main branches. Sea fishing is done chiefly by men who work at it for a livelihood, and to whose efforts are due a considerable portion of the world's food supply. In this trawling plays an important part. The other branch is known more usually as angling, and is pursued mainly by ama-

teurs for their own amusement, although in America great quantities of salmon are caught for food by professional fishermen. Fly-fishing is a form of angling.

The chief fish caught by the professional are the cod, herring, and mackerel; by the amateur, salmon and trout. Whale fishing, seal fishing, and pearl fishing are special branches.

Fishing is one of the oldest arts practised by man, and there is evidence that he did something of this kind 8,000 years ago. Various devices were employed and some of the earlier forms, made of stone and bronze, have been unearthed. Throughout the ages the existing varieties of rod, bait, and all the accessories were evolved. Close times are enforced by law, while a long series of Acts, which may be

said to date from Magna Carta, lay down the law for the U.K. Dealing with fisheries of every kind, deep sea, inshore, and inland water, they forbid the use of poison or explosives for the purpose of catching fish, make regulations about the registration and management of fishing boats, and lay down conditions for conserving supplies and using them in the interest of the nation.

For England and Wales the law is administered by the ministry of Agriculture and Fisheries while Scotland has its own department for the purpose. The United States, Canada, and other countries are equally vigilant in this matter. International agreements deal with areas, such as the Newfoundland banks and Bering Sea, where men of different nations meet. See Angling; Close Time; Fisheries; Fly Fishing; Trawling.

Fishing Fleet. Term used to describe a number of fishing vessels operating from a single home port, or vessels from different ports fishing in the same grounds. In a general sense it includes all vessels fishing under the same national flag; in Great Britain there are the Merchant Navy and Fishing Fleets. The latter includes not only steam and motor trawlers and drifters for deep-sea fishing, but also the longshoreman's yawl for line fishing in coastal waters. Grimsby, Lowestoft, Yarmouth, and Aberdeen all have large fishing fleets, consisting mainly of trawlers divided into three main groups: the small type, between 70-110 ft. long, which catch first-quality fish in home waters such as the North and Irish Seas; medium-sized vessels up to 140 ft. long, which fish the outer waters of the North Sea; and large trawlers of 130-180 ft. long, which go to Iceland, Bear Island, the White Sea, Greenland, and the Davis Straits. Equipped with radio, ice storage accommodation, and liver oil extractors, these vessels steam up to 5,000 miles during a voyage of 5-6 weeks and may bring home cargoes of 300 tons of fresh fish.

The largest single fishing fleet in Great Britain is that engaged in netting herrings; about 450 steam and motor drifters work from British ports during the herring season. Drifters vary

between 50-100 ft. in length, and of recent years the tendency has been to fit them with motors instead of steam engines. The most notable fishing fleets outside Great Britain are the French ships which each year sail to Labrador for cod, and the Newfoundland motor dorries which operate off the Grand Banks.

During the Second Great War trawlers and drifters were requisitioned from the British fishing fleets for service with the Royal Navy as minesweepers, escort vessels, and patrol ships. In 1938, the British fishing fleets numbered 13,700 vessels aggregating 275,000 tons, of which 4,400 were sailing vessels and 9,300 steam and motor ships. The number of men and boys employed as crews was 56,000. The total losses suffered in the Second Great War, among vessels serving with the R.N. and those attacked in the fishing grounds, were 384 trawlers and 41 drifters.

Fishing Rod. Rod used by anglers. Its purpose is to cast the line and keep it clear of the bank or shore upon which the fisherman is standing, and it varies with the nature of the sport. Salmon fly rods, which are liable to great strain, are usually of cane with a steel rod in the centre, and measure from 16 ft. to 17 ft. 6 ins. For trout and other fresh-water fishing a lighter rod from 12 ft. to 13 ft. in length has been found the most suitable. Fishing rods are usually jointed in sections for greater convenience, and are fitted with a reel to wind in the line. See Angling.

Fishkill. Village of New York state, U.S.A., in Dutchess co., E. of the Hudson, 5 m. N.E. of Beacon. One of the oldest places in the state, it was settled by the Dutch and has two churches dating from the 18th century, one being the building in which the provincial convention of New York met in 1776, and in which deserters and spies were held during the Revolution. Cider making is the chief industry. Pop. 720.

Fish Lice. Small crustaceans of the order Copepoda (*q.v.*), which are parasitic on fishes. They depart widely from the typical forms of the order.

Fish Measure. Special measures of capacity used in the sale of fish. These can be summarised thus: 4 fish make 1 warp; 33 warps, a long hundred; 10 long hundreds, a long thousand; 10 long thousand (13,200 fish), a last. In addition to this 500 herrings make a code, 600 herrings a mease, and 615 herrings a maze; 37½ gallons of fresh herrings equal a cran, and 26½ gallons of cured herrings a barrel. A barrel of anchovies is 30 lb.

Fishmongers' Company. London city livery company. Founded to exercise a monopoly of the fish trade of London, and originally divided into two companies, Salt-fishmongers and Stock-fishmongers, its earliest extant charter is dated 1364, but the foundation fraternity of S. Peter existed in the 12th century. Sir William Walworth and Thomas Doggett (*q.v.*) were members.

King George VI was made a freeman of the company. The company examines all fish brought into Billingsgate. The hall in Upper Thames Street, E.C., was built in 1831-33, near the site of its two predecessors, the first of which was burnt in 1666 and rebuilt 1671. It was severely damaged by air raids in 1940. In it are shown Walworth's dagger, an embroidered Tudor pall, and a chair made from one of the original piles of old London Bridge.

Fish Residues. Fish offal suitable for manufacture into various by-products. The main products are fish meal, oils from the livers of fish, and oil and manure from the intestines. Fish meal is made chiefly from the head and bones; it is a valuable food for cattle and pigs. Medicinal

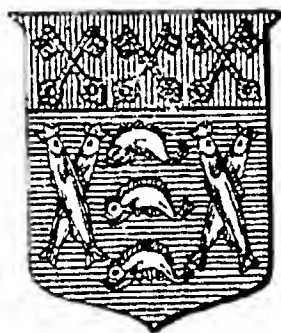
oil is principally the product of the livers of the cod and halibut. Other oil used in commerce and industry, especially in the process of tinning and in the manufacture of margarine and soap, is extracted from the livers and intestines of various fish. Fish manure is a valuable fertiliser, used particularly in the growing of beet.

The fish from which most of the waste material is obtained include herring, codfish, whiting, haddock, pilchard, and menhaden. A large amount of herring waste is obtained from the herrings prepared for curing, in which usually the head, the gills, and the viscera are rejected. In making kippers from herrings the gills and viscera are rejected. From the codfish the liver is always separated for the manufacture of cod-liver oil, the head, gills, viscera, and the backbone being used for by-products.

The industry is extensive in the U.S.A. and in Norway, but is still in its infancy in Great Britain, where in many fishing ports there is no provision for utilising the waste, which is emptied into the sea. Factories already exist, however, at Grimsby, Hull, Milford Haven, Falkirk, Montrose, Fraserburgh, Wick, and Aberdeen. The industry has received considerable stimulus from the shortage of the supplies of natural guano from Peru. Two kinds of fish guano are made, one from herring, the other from white fish. The former contains a large percentage of oil, which has to be extracted in the manufacture of guano, the product from the oily residues being a dark-coloured, soft fish guano. The product from the white fish is a dry, friable, light-coloured, more valuable guano. The value of fish guano depends upon its ascertained chemical analysis, the two most valuable constituents being phosphate of lime and nitrogen.

Cod-liver oil comes from the liver of that fish, the oil in white fish being accumulated in the liver instead of being scattered throughout the flesh, as it is in the herring. Hence the livers of the cod when caught are immediately separated, kept fresh, then broken up and allowed to ferment, after which they are cooked until the oil is free, and can be run off. A certain amount of stearine is present in this oil, and must be separated before the oil is used medicinally.

Sardine oil is obtained from the heads of the fish tinned in France and Spain. Menhaden oil, collected in the U.S.A., is used to make certain paints.



Fishmongers' Company arms



Fishing Rod. Left, salmon rod and three joints; right, pike rod and joints

By courtesy of S. Allcock & Co.

Fiske, JOHN (1842–1901). An American historian and philosopher. Born March 30, 1842, he was educated at Harvard, where he became lecturer on philosophy and assistant librarian. In philosophy, especially in Outlines of Cosmic Philosophy, 1874, he did much to popularise the evolutionist theory, combined with a belief in immortality, which he supported. His historical works cover most of the development of the U.S.A. from the earliest times to his day. He died July 4, 1901



John Fiske

Fisk University. An American educational institution. Founded in 1866 at Nashville, Tennessee, it is for the education of coloured persons and is named after Clinton B. Fisk (1828–90), an American soldier and philanthropist, who was active in its creation. The teaching given at Fisk is somewhat off the ordinary university lines. Money for its endowment was raised in Great Britain by the Jubilee Singers (*q.v.*), as they were called; coloured men also gave concerts, etc., for this purpose.

Fission. In atomic physics, the name given to the disintegration of the nuclei of some elements into two or more approximately equal fragments when exposed to bombardment by neutrons of the correct speed. While most elements when bombarded by neutrons (or other particles) divide sooner or later into an almost unchanged nucleus and a light particle such as a proton, a few elements, *e.g.* uranium and thorium, exhibit the phenomenon of fission which may be accompanied by a large release of nuclear energy. See Atom; Atomic Weapons; Nuclear Fission.

Fissurellidae (late Lat., little fissures). Family of small limpets which have a hole at the apex or margin of the shell, whence their popular names, keyhole and slit limpets. Five species are found around the British coasts.

Fistula (Lat., pipe). Abnormal opening between a cavity in the body and the skin, or between two cavities in the body. For instance, a communication between the rectum and bladder is termed a recto-vesical fistula.

Fit (A.S. *fitt*, struggle). Popular term for a sudden seizure, accompanied by loss of consciousness

with or without convulsions. See Convulsions; Epilepsy; Hysteria.

Fitchburg. City of Massachusetts, U.S.A., one of the co. seats of Worcester co. On a branch of Nashua river, 49 m. W. by N. of Boston, it is served by rlys. Settled 1719, it was incorporated 1764, and received a city charter 1872. Fitchburg manufactures textiles, clothing, shoes, paper, saws, guns, knives, and locks, and quarries granite. It has a high school known for the Fitchburg Plan originated in 1911, which established a cooperative system under which boys studying engineering divided their week between classes and work as paid apprentices in local industry. Pop. (1950), 42,691.

Fitchée (Fr. *fiché*, fixed). In heraldry a cross with a spike at its lower extremity is said to be fitchée or fitchy. It represents the proper cross of the old pilgrims and crusaders, which was stuck in the earth to improvise an altar.

Fitchett, WILLIAM HENRY (d. 1928). Australian author and journalist. Educated at Melbourne university, he entered the Methodist ministry. He edited the Melbourne Daily Telegraph and Southern Cross, and became principal of the Methodist Ladies' College. In 1897 his book, Deeds that Won the Empire, attained immediate success. His other works include How England Saved Europe, 1899; Fights for the Flag, 1900; Wellington's Men, 1900; Nelson and his Captains, 1902; Wesley and his Century, 1906; The Tale of the Great Mutiny, 1907. He died May 24, 1928.

Fitter. Term used in engineering to designate the workman who assembles parts of machinery and makes them fit. The work is highly skilled. The term is also applied in tailoring to one who takes measurements, and adjusts garments to fit their wearers.

Fitter is also a trade classification in the British army and the R.A.F. Army fitters attached to mechanical transport units are responsible for the upkeep of vehicles, and ordnance corps fitters are employed in the maintenance of guns and other weapons. In the R.A.F. there are fitters, engine; fitters, armourers; fitters, marine; and fitters, motor transport. These trades are among the most highly skilled and best paid.

Fitz (Lat. *filius*; Fr. *fil*). Old Anglo-Norman word formerly spelt *fiz* and meaning son. Like Scots Mac, Irish O', and Welsh ab, ap, it is prefixed to proper names to show parentage. Familiar ex-

amples are Fitzalan, Fitzgerald, and Fitzwilliam. It is specially used to indicate natural sons of royal blood, *e.g.* Fitzjames, duke of Berwick, son of James II.

Fitzgeorge. Name taken by the three sons of the duke of Cambridge and his morganatic wife, Miss Louisa Fairbrother, the actress, whom he married in 1840. One of them, Sir Adolphus Augustus Frederick Fitzgeorge (1846–1922), entered the navy and retired as rear-admiral. In 1904 he was knighted. Another, Sir Augustus Charles Frederick Fitzgeorge (1847–1933), entered the Rifle Brigade in 1865 and later served in the 11th Hussars. He retired as a colonel and was knighted in 1904.

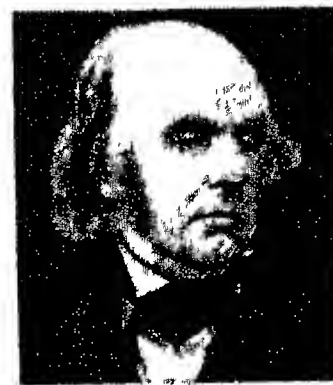
Fitzgerald, LORD EDWARD (1763–98). Irish rebel. Son of the 1st duke of Leinster, he joined the English army, served in Ireland, and in 1781 was wounded at the battle of Eutaw Springs in America. He was elected to the Irish parliament as member for



Edward Fitzgerald

Athy, afterwards travelled in America, and in 1792 was cashiered for attending a revolutionist banquet in Paris. He joined the United Irishmen in 1796 and took an active part in the plans for the French invasion. The plot was discovered and Fitzgerald died in prison, June 4, 1798, from wounds inflicted by one of his captors. His wife Pamela was generally, but wrongly, believed to be a daughter of Madame de Genlis by Philippe Egalité, duke of Orleans. She was probably born in Newfoundland. She married Fitzgerald in 1792 and lived until Nov., 1831.

FitzGerald, EDWARD (1809–83). English poet and translator. He was born March 31, 1809, at Bredfield House, near Woodbridge, Suffolk, the son of John Purcell, who assumed his father-in-law's name, FitzGerald, nine years after the poet's birth. Spending his boy-



Edward FitzGerald

hood abroad, he was sent, in 1821, to a school in Bury St. Edmunds, entering Trinity

College, Cambridge, five years later. He became intimate with Thackeray and Spedding; later with Tennyson and Carlyle. On leaving the university he spent a short time in France, but returning to Suffolk in 1831 never left it again, for more than a week or two, till his death, June 14, 1883.

His life, spent among books, flowers, and music, was that of a recluse; he began the study of Spanish in 1850, that of Persian in 1853. His world-famous translation of *The Rubáiyát of Omar Khayyam*, preceded in 1856 by an anonymous version of the *Sálamán and Absál of Jami* in Miltonic verse, was first published in Jan., 1859; but lay for months neglected, even by the translator's own friends, until Rossetti discovered it in the fourpenny box of a second-hand bookseller, and Swinburne proclaimed its genius to the world. A second, greatly revised, edition appeared in 1868, and its subsequent popularity has been phenomenal. FitzGerald also published *Euphranor*, a Platonic Dialogue, 1851; *Six Dramas of Calderon*, 1853; a version of the *Agamemnon*, 1876; two *Oedipus Tragedies*, 1880-81; and *Readings in Crabbe*, 1882. The dedication of Tennyson's *Tiresias* to "Old Fitz" advanced FitzGerald's personal reputation, but it was not till W. Aldis Wright brought out, in 1889, his *Letters and Literary Remains*, and, in 1895, his *Letters to Fanny Kemble*, that the world knew much of the man whose work it had long since taken to its heart.

He married, in middle life, Lucy, daughter of Bernard Barton, the Quaker poet, and the interest of his later years was centred in the sea, "knocking about somewhere outside of Lowestoft," as he puts it himself. He was a witty, picturesque, and sympathetic letter-writer, on terms of intimacy with the most interesting men and women of the day. His verse is tranquil and exquisite: the cultured expression of most attractive speculations.

Bibliography. *Letters and Literary Remains*, ed. W. A. Wright, new ed. 1902; *Letters to Fanny Kemble*, 1895; *Two Suffolk Friends*, F. H. Goorme, 1895; *Lives*, J. Glyde, 1900; T. Wright, 1904; A. C. Benson, 1905.

Fitzgerald, Percy Hetherington (1834-1925). Irish writer. Born in co. Louth, he went to Stonyhurst and Trinity College, Dublin. Called to the Irish bar, he became crown prosecutor, but abandoned law for literature. He contributed stories to Dickens's

All the Year Round, and produced a study of Dickens, whose friendship he enjoyed, and historical and theatrical works, also *Memoirs of an Author*. He engaged in sculpture as a hobby, and his statue of Dr. Johnson stands in London in the churchyard of S. Clement Danes. He died Nov. 24, 1925.

Fitzherbert, Maria Anne (1756-1837). Wife of George IV. A daughter of Walter Smythe, of Brambridge, Hampshire, she married in 1775 Edward Weld, of Lulworth Castle, Dorset. Her second husband was Thomas Fitzherbert and after his death in 1781 she lived at Richmond. In 1785 she met the prince of Wales, who fell in love with her, but to avoid his attentions she went abroad. He pressed his suit, however, and the pair were married privately on Dec. 21, 1785.

According to the Royal Marriages Act, 1772, the union was illegal, and some, but not the prince, held that it was invalid; the lady being a Roman Catholic, it was sanctioned by the pope. In 1795 George married Caroline of Brunswick and Mrs. Fitzherbert left him for a time. They lived together again until 1803, when the prince began to tire of her. They finally parted, but George seemed to retain some affection for her to the end. Mrs. Fitzherbert, who had an allowance of £6,000 a year, died at Brighton, March 29, 1837. A box of papers was left by her to her executors for use at their discretion, but its contents were never fully examined. Consult Mrs. Fitzherbert and George IV, W. H. Wilkins, 1905.

Fitzmaurice, Edmund George Fitzmaurice, 1st Baron (1846-1935). British politician. Born June 19, 1846, second son of the 4th marquess of Lansdowne, he was educated at Eton and Trinity, Cambridge, and called to the bar in 1871. During 1869-85 he was M.P. for Calne. In 1880 he was commissioner for the reorganization of the European provinces of Turkey and Crete; in 1882-83, second plenipotentiary at the Danube conference in London. In 1882 he became under-secretary for foreign affairs in the Liberal ministry, but in 1885 lost his seat. Cricklade elected him in 1898 and



Mrs. Fitzherbert,
wife of George IV
After R. Cosway

he retired in 1905. Again under-secretary for foreign affairs, he was made a peer in 1906. Lord Fitzmaurice wrote *Lives of the Earl of Shelburne* (1875-77) and *Earl Granville* (1905). He died without an heir, June 21, 1935.

Fitzmaurice-Kelly, James (1857-1923). British man of letters. Born in Glasgow, June 20, 1857, he devoted himself to the study of the language and literature of Spain. He was Taylorian lecturer at Oxford, 1902; Norman MacColl lecturer at Cambridge, 1908 and 1912; Gilmour professor of Spanish at Liverpool, 1909-16; and professor (Cervantes chair of Spanish) at King's College, London, 1916-20. His works include *Life of Cervantes*, 1892; *A History of Spanish Literature*, 1898; *Lope de Vega and the Spanish Drama*, 1902; *Editions of Cervantes in English*, 1901-03, and the *Oxford Book of Spanish Verse*. He died Nov. 30, 1923.

Fitzpatrick, Sir Charles (1853-1942). Canadian lawyer. Born in Quebec, Dec. 19, 1853, he was educated at St. Anne's college and Laval university there. In 1876 he became a barrister, and in 1879 crown prosecutor for Quebec. From 1890 to 1896 he was a member of the legislative assembly of Quebec. At the general election of 1896 Fitzpatrick entered dominion politics as member for the same city in the house of commons at Ottawa. That year he was solicitor-general under Laurier, and in 1902 became minister of justice. In 1906 he was chosen chief justice of Canada, retaining this post until made lieutenant-governor of Quebec in 1918. In 1907 he was knighted. During the years 1908-10 he was a member of the Hague tribunal. He died in June, 1942.

Fitzroy. River of Queensland, Australia. It is formed by the union of the Dawson with the Mackenzie, and takes an easterly course to discharge into Keppel Bay. It is navigable for steamers up to 1,000 tons to Rockhampton, a distance of 35 m. One of the most important rivers in Queensland, its fertile valley contains stock farms which supply the refrigerating works on the coast. Irrigation is practised by pumping from open water and from underground supplies.

Another river of this name in W. Australia rises in King Leopold range, and pursuing a generally westerly course empties into King Sound on the Indian Ocean. It is navigable for 100 of its 300 m.

Fitzroy. North-eastern suburb of Melbourne, Victoria, Australia. It is a manufacturing centre, with a rly. station and several large recreation grounds, including the Edinburgh Gardens to the N.E., the Carlton Gardens to the S.W., and the Fitzroy Gardens to the S., laid out with fine avenues of trees.

Fitzroy, SIR ALMERIC WILLIAM (1851–1935). British public official. He was born Nov. 12, 1851, and went to Balliol College, Oxford. Entering the educational department of the privy council in 1876, he acted as secretary, and in 1898 was appointed clerk of the privy council, resigning in 1923. He was chairman of committees on physical deterioration, 1903–04; the Midwives Act, 1909; member of Royal Commission on venereal diseases, 1913–16; sat on the Dentists' Act committee, 1918–19. He was knighted in 1911. In 1921 he published a biography of Henry, duke of Grafton, in 1923 his own memoirs. He died May 31, 1935.

Fitzroy, EDWARD ALGERNON (1869–1943). British politician. Born July 24, 1869, son of the 3rd Lord Southampton, he was educated at Eton and Sandhurst, and joined the 1st Life Guards. He was Conservative member of parliament for South Northamptonshire during 1900–06, and from 1910 continuously. He was deputy-chairman of committees, house of commons in 1922; and in 1928 he succeeded J. H. Whitley (*q.v.*) as Speaker. Fitzroy was the first soldier to be given this office, and the first to die holding it, as he did on March 3, 1943. His widow Muriel was granted the title of Viscountess Daventry.

Fitzroy, ROBERT (1805–65). A British sailor. Son of Lord Charles Fitzroy, he was born in Suffolk, July 5, 1805. He entered the R.N. College in 1819, and became lieutenant in 1824. In 1831–36 he sailed in command of the *Beagle*, a brig engaged in surveying the S. coast of S. America, with Charles Darwin as naturalist. In 1839 Fitzroy published his *Narrative of the Surveying Ships H.M.S. Adventure and Beagle*, in three volumes, the last written by Darwin. In 1841 he was M.P. for Durham, and in 1843 was appointed governor of New Zealand, but his attitude towards the settlers incurred their anger and he was recalled in 1845. He became vice-admiral in 1863 and died April 30, 1865. He is remembered by his Fitzroy barometer and for creating a system of storm warnings which developed into the daily weather forecast.

Fitzroy's Cypress (*Fitzroya patagonica*). Evergreen tree of the family Coniferae. A native of Patagonia, it has slender, spreading branches and flat, overlapping, oval-oblong leaves. The cones are small and star-shaped, consisting of nine scales. The height of the trunk is 100 ft.

Fitzsimons, ROBERT (1862–1917). British pugilist. Born at Helston, Cornwall, June 4, 1862, he went to New Zealand at the age of nine, and was trained as a blacksmith. He entered the ring as a professional, and moved to Sydney, where he beat Bill Slam, West, and Professor Hall, but was beaten by Jem Hall in the contest for middleweight championship.

Proceeding to the United States in 1890, he defeated Jack Dempsey—to be distinguished from the later pugilist of the same name—in 13 rounds in the fight for the middleweight championship of the world; beat Peter Maher in 12 rounds; and in 1897 obtained the heavyweight championship at Carson City. In 1899, he was defeated by Jeffries, and in 1902, at 40, he challenged Jeffries again, to be beaten in the eighth round after putting up a splendid fight. In 1905 he was beaten by Jack O'Brien, and after meeting Jack Johnson and Bill Lang, he retired from the ring in 1912 after an exceptionally long career. "Bob" Fitzsimons died Oct. 22, 1917.

Fitzwilliam, EARL. A British title held by the family of Fitzwilliam since 1746. The family traces its descent from Sir William Fitzwilliam of Elmley, Yorkshire. It became specially prominent in the time of Elizabeth I. Sir William (1526–1599), the grandson of a London merchant who was also a servant of Cardinal Wolsey, passed much of his time in Ireland as lord deputy, 1571–75 and 1588–94, and acquired lands there. His grandson was made an Irish baron in 1620.

William, the 3rd baron (1643–1719), was created a viscount and an earl in 1716. Another William was made baron (1742) and earl (1746) in the peerage of the U.K. He married Anne, daughter of the marquess of Rockingham, a union that brought Wentworth Woodhouse, near Rotherham, and large estates to the family. The 2nd earl, William Wentworth, is noticed separately (*v.i.*). In 1952 William (b. 1904) succeeded his 3rd cousin as 10th earl. The earl owns large estates in Yorkshire and Wicklow. An eldest son is called Viscount Milton.

Fitzwilliam, WILLIAM WENTWORTH FITZWILLIAM, 2ND EARL (1748–1833). A British statesman.



Born May 30, 1748, he succeeded the first earl in 1756. In 1782, on the death of his uncle, Lord Rockingham, he succeeded to the York-

Wentworth Fitzwilliam
After W. Owen

shire estates of the Wentworths and added their name to his. He was president of the council in 1794, and in 1806–07. Lord-lieutenant of Ireland for a few months in 1795, he was recalled on expressing sympathy with Catholic emancipation. In 1798 he was appointed lord-lieutenant of the W. Riding of Yorkshire, but was dismissed in 1819 for censuring the Manchester magistrates over the incident called the Peterloo massacre. A life-long friend of C. J. Fox, Fitzwilliam died Feb. 8, 1833.

Fitzwilliam House. Institution of Cambridge University. A body called the Non-Collegiate Students, founded in 1869 to provide higher education more cheaply than do the colleges, in 1887 bought Halstead House, with which it was already associated, reconstructed it, and in 1892 named it Fitzwilliam Hall (renamed Fitzwilliam House, 1924). The building dates from 1727, perhaps earlier.

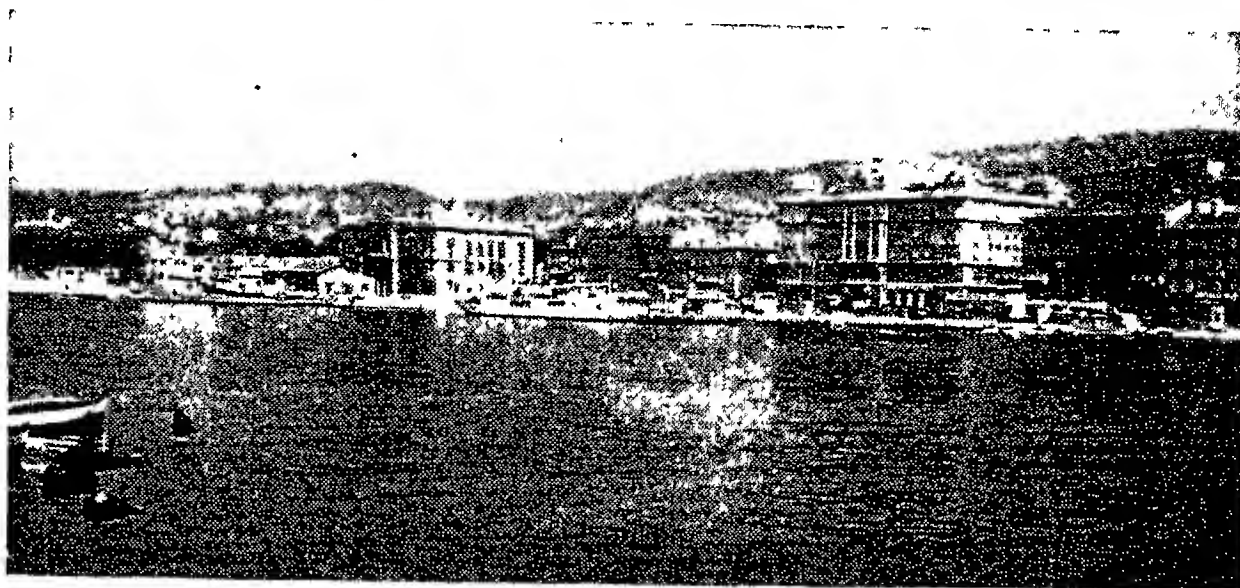
Social and collegiate life having developed (especially under W. F. Reddaway, censor 1907–24), this was recognized in 1934 when the title Non-Collegiate Students was dropped, and the institution became officially Fitzwilliam House. It is administered by a board appointed by the council of the senate; the board appoints the censor, who acts as senior tutor. Dining and the tutorial system are compulsory.

Fitzwilliam Museum. Art and archaeological museum in Cambridge, founded in 1816 by Richard, 7th Viscount Fitzwilliam of Merrion, who bequeathed to the university his collections of pictures, drawings, prints, medieval MSS., books, etc., together with an endowment for the provision of an exhibition gallery. This was begun in 1837 from the designs of George Basevi and finished in 1874 from those of E. M. Barry. The pictures include works by Titian, Tintoretto, Veronese, Rubens,

Rembrandt, Hals, Gainsborough, Reynolds, Cézanne, Renoir, and Degas. 16th and 17th century masters and mezzotints of the 18th century are well represented in the print room. Among the MSS. are fine English, French, Italian, and Netherlandish examples. A collection of ceramics has a particularly fine English series and products of European factories and of the Near and Far East. The collection of coins is among the richest in Europe. Other departments are those of armour, textiles, Greek and Roman antiquities, and music. See Cambridge University illus.

Fiume. Seaport on the Adriatic. It stands on the river Rečina, at its outfall into the Bay of Quarnero, at the N.E. extremity of the Adriatic. It has several harbours—the Fiumara canal, used by coasting vessels; the Baross harbour; the main harbour, which is protected by a mole; and the free and petroleum harbours to the W. Virtually all the shipping trade of Hungary passed through its port, and the fisheries are of great importance. The town possesses distilleries, petroleum refineries, and mills, while there is trade in fruit, barrels, staves, furniture, tobacco, paper, chemicals, fertilisers, and soap. In architecture, the cathedral, the Roman triumphal arch, and the governor's residence may be mentioned. Under the Austro-Hungarian empire Fiume was a crown-land of Hungary, with an area of 8 sq. m. The pop. was largely Italian, but the suburb of Sushak across the river, and the surrounding area, were inhabited by Yugoslavs, chiefly Croats. Pop., pre-war, 53,896.

Fiume's mixed population of Italians, Croats, Magyars, and others made it a point of racial dispute. Long a small centre of coastwise trade, it came into prominence only when the Budapest-Zagreb-Fiume railway was built. Originally known as S. Vitus in Flumine, in 1465 it became a Hapsburg possession. Charles VI declared it a free port in 1717, and in 1776, by a decree of Maria Theresa, it was handed over to Croatia. In 1807 it was incorporated in Hungary. Two years later, under Napoleon, it became part of Illyria. In 1822 Fiume was restored to Hungary, but as a result of the Croatian national movement of 1848 was reunited to Croatia. In 1861 it was made autonomous. The Magyars favoured the Italian section of its inhabitants, and for nearly fifty years this union strove to prevent Slav predominance.



Fiume. View from the sea of this Adriatic port, ceded to Yugoslavia by Italy in 1947. Its Yugoslav name is Rijeka

After the First Great War possession of Fiume became a burning question. Though not assigned to Italy by the treaty of London (1915), it was claimed as Italian because it contained a majority of Italian-speaking inhabitants. The Croats, and on their behalf the new Serb-Croat-Slovenegovernment, claimed it historically and on the ground that with Sushak it was inhabited by a majority of Southern Slavs.

The feeling between Yugoslavia and Italy as to its possession became more strained. Matters came to a head when on Sept. 11, 1919, Gabriele d'Annunzio (*q.v.*), at the head of the Italian volunteers, seized Fiume and set up a national council or provisional government. On Nov. 12, 1920, the treaty of Rapallo, signed by the representatives of Italy and Yugoslavia, established an independent state of Fiume which was to be slightly larger than the district formerly incorporated in Hungary. Insurgents denounced the treaty, and d'Annunzio declared that Fiume was in a state of war with Italy. The government of the latter expelled the insurgents. In 1924, by an agreement defining their relations in regard to the Adriatic, Fiume was annexed by Italy, while Baross harbour and the Delta were annexed by Yugoslavia. One of the four docks of Fiume was to be leased to Yugoslavia for 50 years in return for the yearly payment of a fixed sum; the railway station to be under a sort of international regime.

Marshal Tito's Yugoslav forces occupied Fiume (Yugoslav, Rijeka) on April 30, 1945. It was included in the territory ceded to Yugoslavia by Italy under the peace treaty of 1947.

Five Knights' Case, THE. Trial in the court of king's bench, Nov. 22, 1627. Sir Thomas Darnell, with four other knights, Corbet, Earl, Hampden, and Heveningham, had been committed to the Fleet prison in March by warrant signed only

by the attorney-general for refusing payment of the forced loan raised by Charles I. They applied for a writ of Habeas Corpus, demanding that the warden of the fleet should bring them before the court of king's bench and specify the cause of their committal.

The case came on for argument and the gaoler returned that they were imprisoned by the king's special command, *i.e.* for no stated offence; and the court, presided over by Chief Justice Hyde, decided, Nov. 28, that this was sufficient ground for committal. The prisoners did not deny the right of the crown to imprison in certain circumstances without showing cause, but pleaded that they were imprisoned for refusing to subscribe to the forced loan, of which they denied the legality. See Forced Loan.

Five Members, THE. The five members of parliament whom Charles I tried to arrest, Jan. 4, 1642. Relations between crown and commons were strained when the king ordered the attorney-general to prepare articles of impeachment against the five: John Hampden, John Pym, Denzil Holles, Sir Arthur Hazlerigg, and William Strode. This was done, one of the charges being that of levying war against the king, and the house of lords was asked to order their arrest, a necessary preliminary to their trial before that body. This the peers refused to do, so the king went with the serjeant-at-arms to do it himself; with him were about 300 attendants.

He entered the house just as the warned members had escaped by river to the city, and asked the Speaker for them. Lenthall replied that he could only do as the house directed him, to which the king answered, "I see all the birds are flown." Next day Charles went to the city, but again he failed to secure the five. The impeachment was declared illegal. On Jan. 11 the members returned to

Westminster, a great concourse of people, both on the river and on the banks, cheering their arrival.

Five Mile Act. Act passed in 1665 which forbade those ministers who had been expelled from their livings in 1662 to reside within five miles of any corporate town or teaching in any school. They could obtain relief only by subscribing to the Act of Uniformity and taking an oath that resistance to the king was unlawful. The Act was part of the Clarendon Code, and became inoperative by lapse of time.

The name was applied also to an Act of 1593 by which popish recusants convicted of not going to church were forbidden to go more than five miles from home. Repealed in 1844, it had long been a dead letter.

Five Nations. Name given to the Indian nation of the Iroquois, because it consisted of five tribes. These were Mohawks, Oneidas, Cayugas, Onondayas, and Senecas. Early in the 18th century they were joined by the Tuscaroras and were known as the Six Nations. (See Iroquois.) It is also the name of a volume of poems by Kipling, the five nations being the chief members of the British Empire.

Fives. Game of handball. It is played either with the bare hand or with gloves, though at the present time almost invariably with the

latter. The derivation of the word fives is doubtful, although various suggestions have been made that it is so called from the five fingers of the hand, or that it was played by five people on each side.

Fives was popular early in the 19th century, when it was played in closed spaces especially built for the purpose, and also in tennis courts. One of the most famous fives courts was in S. Martin-in-the-Fields, and there is an old print representing fives in the tennis court in Leicester Fields, which gives some idea of the game as then played. A feature was that the ball was bounced on the ground, and then struck with the hand for the service. The ball nowadays is thrown up so that it touches first the back wall and then a side wall before the receiver hits it. William Hazlitt's obituary of John Cavanagh, the Fives Player, which appeared in *The Examiner*, is the best-known piece in the literature of the game.

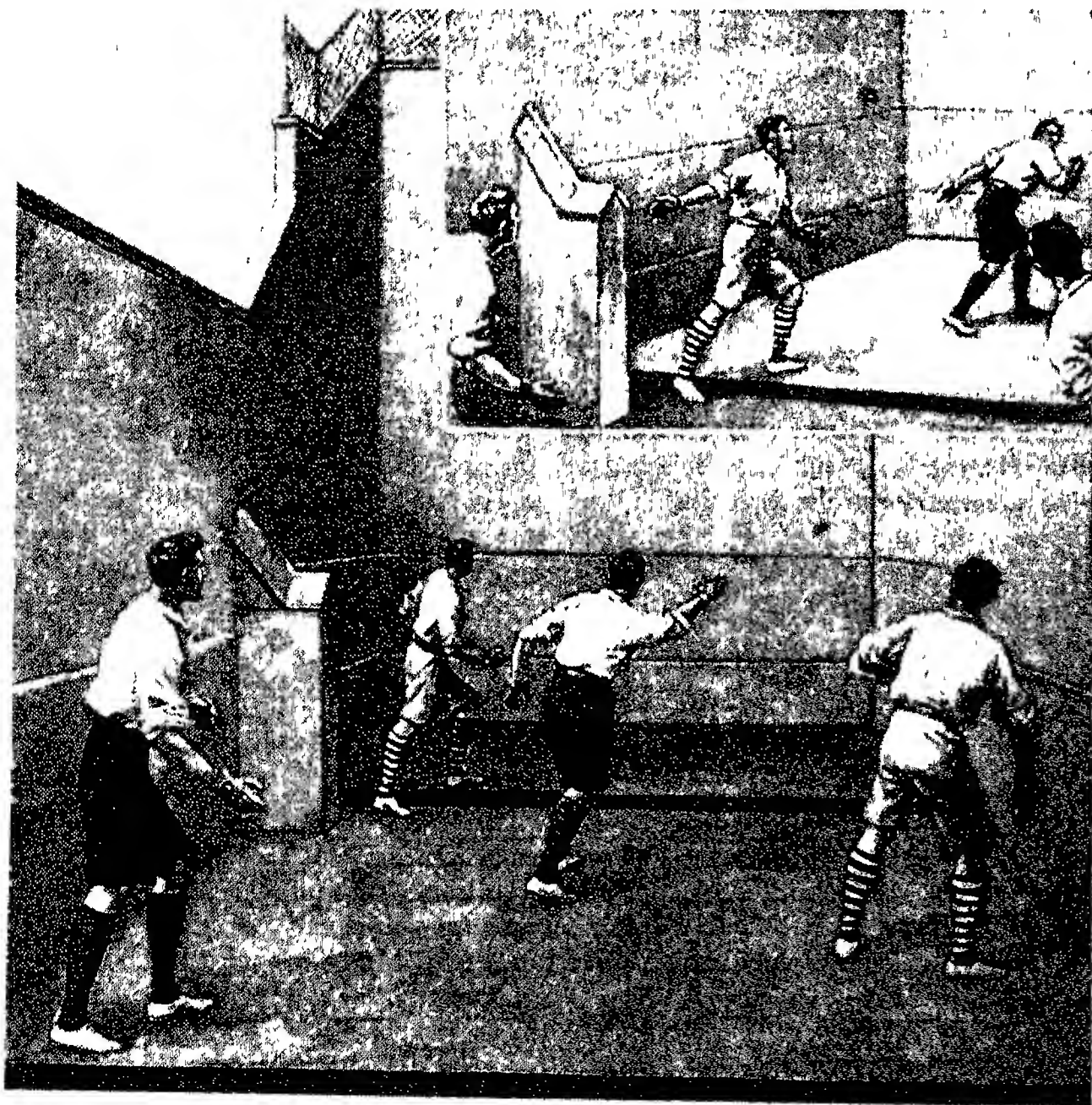
In modern days fives is played chiefly in three forms of court, one being the Eton. The court, unique in several features, originated from part of the chapel at Eton against which the game used to be played. A buttress and some of the chapel steps gave rise to the present hazards in the court which afford so much interest and variety to the

game. The court has three walls, and not long ago all courts were uncovered. Now there are a few courts covered by a pent-house roof. The game needs four players, and demands the highest skill and quickness of movement.

A Rugby fives court, called after the school of that name, is a four-walled building covered with a roof. The walls are all plain, except that on the front wall there is a ledge or board, above which the ball must be struck to be in play. The game is played at most public schools; the rules were revised and brought up to date in 1913. Winchester fives is similar to the Rugby game, except that in the left-hand side wall of the court there is a projecting buttress which forms a hazard. Courts of this kind exist only in one or two places outside Winchester. Like the Rugby game, it can be played by one or two players a side. The service is given by one player throwing the ball on to the wall. His adversary can refuse any service, but if he does not refuse it, he must hit the ball on to the right-hand side wall, and then on to the front wall above the ledge or line.

In all varieties, after the rules of service have been complied with, the game proceeds by rallies, i.e. the ball is returned on the volley or after one bounce and must go above the ledge. The player who first fails to do this loses the rally, and either yields the service to another player or, if he was the receiver, loses a point. A game consists of 15 points. The ball is made like a rackets ball. The foundation is of cloth, bound tightly round with twine and covered with white kid. The weight of the ball in Eton fives is 1½ oz. and in Rugby 1½ oz. Apart from its vogue in public schools, the game is popular in the north of England, specially prepared courts or alleys being in use in co. Durham.

Five Towns, THE. Name given in various novels by Arnold Bennett (*q.v.*), a native of the district, to the towns of the Potteries district of Staffordshire. In reality there were six separate towns—Stoke-upon-Trent, Hanley, Burslem, Tunstall, Longton, and Fenton—federated in 1910 into one administrative co. borough which became the city of Stoke-on-Trent (*q.v.*) in 1930. Bennett's five were thinly disguised as Knype, Hanbridge, Bursley, Longshaw, and Turnhill; and he extended the topographical analogy in other details, e.g. Waterloo Road, from Burslem to Coat-



Fives. An Eton game in progress, illustrating the construction of the court. Inset, about to volley for the pepper-box

bridge, became Trafalgar Road, from Bursley to Bleakridge. Novels introducing the Five Towns include *The Old Wives' Tale*, *Clayhanger*, *Hilda Lessways*, *These Twain*, *The Card*, *Whom God Hath Joined*, *Anna of the F.T.*, *Leonora*, and *Helen with the High Hand*; there are also three volumes of short stories, *Tales of the F.T.*, *The Matador of the F.T.*, and *The Grim Smile of the F.T.*

Five Year Plans. Form of economic planning developed in the U.S.S.R. The first plan, 1927-1932, provided for the creation of basic industries under a central planning office. The second, 1932-37, and third, 1937-42, dealt mainly with the processing industries and the production of articles for the home market. The fourth plan, 1946-50 inclusive, had as its objectives the rehabilitation of war-devastated districts, the restoration of industry and agriculture, and the surpassing of the pre-war level of production.

The first three programmes were fulfilled in the main, but at the cost of great privation inflicted on the population and the retention of a low standard of living. By 1938 industrial production was nine times greater than in 1913; but agricultural developments were not in proportion, the peasants having destroyed large numbers of stock and wasted grain in face of forced collectivisation. The five year plans were based on the principle that the Soviet Union must be self-sufficient, foreign trade being taken into account only where the acquisition of foreign currency was necessary. The fourth programme called for an increase in industrial output of 48 p.c. as compared with 1940, in farm produce of 27 p.c. Each republic was allotted a "target" figure for its industries and a capital sum for the execution of its task.

The development of the iron and steel centres of the Urals, Siberia, and the Far East continued; new mines and plants expanded the non-ferrous metal industry, especially in Central Asia, N. Urals, and E. Siberia. New mines were projected in the Moscow and Pechora coalfields, and vastly increased production was expected from the Kuznetsk basin, Urals, Ukraine, Caucasus, and Central Asia. Maximum development of petroleum extraction and refining was ordered in the east as well as in the Ukraine. Thirty hydro-electric stations were to be erected; and by 1950 the pro-

duction of synthetic rubber was to be doubled; transport and communications were to be restored and improved. The planning commission's report in 1951 claimed that the plan's aims had been not only fulfilled, but exceeded. Similar detailed five year programmes continued to co-ordinate the Soviet economy.

The idea was later adopted and adapted by other countries, e.g. under the European Recovery Programme and the Colombo Plan (q.v.).

Fixation. Term used in psychology to denote the arrest of an instinct during its growth at some point short of maturity, with the result that the emotions which should accompany the functioning of the instinct retain or regress to a childish form. A mother-fixated man seeks in all his love objects the mother who gives all and asks little or nothing in return. Consult *Psycho-Analysis*, E. Glover, 1939.

Fixed Oils. Term used by the old alchemists and still current in pharmacy. They constitute a homogeneous group of oils present in animal and vegetable organisms. Olive oil, almond oil, linseed oil, castor oil, have been known from earliest times and valued for their emollient and other properties when used externally. Cod liver oil and castor oil have long enjoyed reputations for their medicinal properties. All members of the group are more generally described under *Fatty Oils*.

Fixture (Lat. *figere*, to fix). Term used in English law for a thing of a chattel nature which is affixed to the freehold, so as to become part of it, and, therefore, to become realty and not personalty. Sometimes these things can be removed again by the people who put them there, so that they become personal property again, and sometimes not. Practically, questions about fixtures become important as between landlord and tenant, between the devisee and the personal representative of a deceased, and between the representative of the owner of a particular estate, e.g. a tenant for life, and the ultimate owner. In the second case the devisee is entitled to all fixtures, but in the third the personal representative may remove those put up for ornament or trade if he can do so easily.

As between landlord and tenant the right of removal is stronger. A tenant is entitled to remove all fixtures put up by him for ornament or convenience which can be removed without much damage to the premises, e.g. marble mantel-

pieces, pier-glasses, tapestry, grates, etc., or cupboards fixed in hold-fasts. The tenant may remove trade fixtures unless in so doing he causes serious damage to the property. Similarly agricultural fixtures can be removed, but the tenant must make good any damage he does. A tenant must remove his fixtures before his tenancy expires—he cannot go back afterwards and take them away. If he leaves them behind he has no claim to them, or to compensation for them, as many people suppose; nor can he demand that a succeeding tenant shall pay for them. They are the landlord's property. See *Landlord; Tenant*.

Fizeau's Experiment. This experiment was made by A. H. L. Fizeau (1819-96) to determine the velocity of light. The apparatus consisted of a toothed wheel, which was made to revolve at a definite speed. The teeth of the wheel cut off the view from a light when a certain speed was reached, and enabled calculations to be made of the time taken for the light to travel from its source to a distant mirror and back again. See *Light*.

Fjord. See *Fiord*.

Flaccus. Name of a Roman family. The following were important: (1) Quintus Fulvius, Roman general in the second Punic War. Together with his colleague, Appius Claudius Pulcher, he captured Capua in 212. (2) Marcus Fulvius, one of the commissioners appointed to carry out the agrarian measures of Tiberius Gracchus, who met his death, with Gaius Gracchus, in 121. (3) Marcus Verrius, a grammarian in the reign of Augustus, the author of a work on the Meaning of Words, abridged by Festus (q.v.). The poets Horace and Valerius also belonged to the family. See *Horace; Valerius*.

Flacius OR VLACICH, MATTHIAS (1520-75). Lutheran divine. Born at Albona, Illyria, March 3, 1520,



Matthias Flacius,
Lutheran divine

he studied languages in Venice, and theology at Basel, Augsburg, and Wittenberg, where he came under the influence of Luther and Melanchthon, and was appointed

professor of Hebrew in 1554. Henceforth he was involved in a series of controversies, siding with Luther against Melanchthon. He settled in turn at Magdeburg, Jena,

where he was professor of theology. Ratisbon, Antwerp, Strasbourg, and Frankfort-on-the-Main, where he died in poverty, March 11, 1575.

One of the charges against Flacius was that of Manichaeism, based on his statement that sin was inherent in human nature from the Fall. The work in which this appeared, *Clavis Scripturae Sacrae* (Key to Holy Scripture), 1567, formed the basis of biblical hermeneutics, a term defining the principles and laws governing biblical interpretation as distinguished from exegesis (*q.v.*). Other works of Flacius replied to the Roman objection to the Reformation as a mere innovation, and traced Church history from an evangelical standpoint.

Flag (*Iris*). A large genus of perennial herbs. Of the family Iridaceae, they are natives of the N. temperate regions. The species form two groups: one in which the rush-like foliage dies down each autumn, and the life of the plant is continued by a long bulb-like root-stock; the other in which the thick, sword-shaped leaves arise



from stout, slightly creeping rhizomes. The term flag is generally applied to members of the second group, the others being spoken of by the name *Iris* (*q.v.*). The leaves enfold each other at the base, and from their midst rises the flower stem, bearing the large brightly coloured flowers.

There are three sepals and three petals, the sepals much larger than the petals, and the stigmas expanded to look like petals. The yellow flag (*I. pseudacorus*) is common in ditches and marshes. The blue flag (*I. germanica*), so common in gardens, is wild in S. and Central Europe. The seed vessel is a large, leathery

capsule, splitting when ripe into three pod-like divisions, packed with large flattened seeds.

Flag. A sheet of stuff, parti-coloured, or of a single colour, plain or bearing symbols, and flown from a staff or halyard. Flags may be national or personal. They were known to the ancients, though the standard or symbol placed on the top of a staff, like the Roman eagles, was more common. This was followed by the gonfalon type, and then by the guidon, a small piece of stuff attached to a lance. In medieval days the shapes and sizes of flags were diverse, but were soon strictly regulated. The standard was a large and long flag, often with one, two, or more points, parti-coloured and decorated with crests, badges, and devices. The banner was large and square, or rectangular, emblazoned with armorial devices, and denoted that the bearer was entitled to levy and lead troops.

The standard with one point was known as the guidehomme (abbreviated into guidon); the ancient was a small guidon; the pennon (bearing badges and motto only) was half the size of the guidon, and had one tail; the pendant was the ship's guidon; the pennoncelle or pencil, a small pennon, attached to a lance and usually bearing a single heraldic symbol; the pavon was a triangle, with horizontal base, the banderolle a long narrow flag or streamer, such as the modern pennant.

National flags evolved slowly. The English white flag with the red cross of S. George appears to have been introduced by Richard I on his return from the East, but it long appeared side by side with many others, including the royal armorial banner. The British national flag is the Union Jack (*q.v.*). The white ensign, consisting of the red cross of S. George and the union flag in the jack, or upper left quarter, may be worn only by ships of the Royal Navy and yachts of the Royal Yacht Squadron. The blue ensign is the flag of the Royal Naval Reserve, worn only by merchant ships whose commanders and a certain proportion of the crew are members. Subject to conditions, 37 British yacht clubs are entitled to the blue ensign, and 32 to the blue ensign defaced with the club badge. Defaced with crossed swords in the fly, the blue ensign is worn by ships operated by the War office. The red ensign, which has

a Union flag in the jack, is the flag of the merchant navy and may be worn by six British yacht clubs, provided it is defaced with the club badge.

Yacht clubs entitled to fly the blue or red ensigns must have an Admiralty permit, the issue of which depends upon strict conditions. The yacht must be registered at a British port and owned by a British subject belonging to one of the clubs recognized in the Navy List. Warrants are granted only to yachts used for cruising, and should a yacht be turned to commercial purposes the permit is at once withdrawn. Admiralty regulations prohibit the wearing of ensigns without warrant on the Upper Thames, the Norfolk Broads, or Cumberland lakes, or any other tidal waters, rivers, lakes, or inland waters.

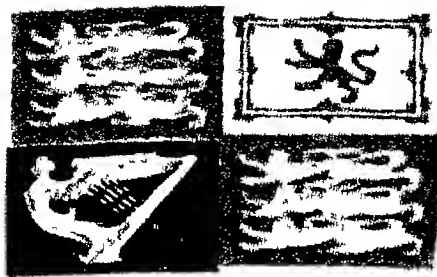
By the Merchant Shipping Act of 1894, no British merchant ship may fly at the stern any flag except the red ensign, unless her master is entitled to the blue ensign. In no circumstances may either ensign carry a house-badge or other distinctive mark. Most British dominion and colonial flags consist of the blue or red ensigns with a Union flag in the jack and national emblems or shields in the centre or fly. Regimental flags have a field the colour of the regimental facings, and the regiment's badge and battle-honours in the centre. See Colours; Ensign.

Flagellants (Lat. *flagellum*, little whip). Name given to various ascetic bodies in the R.C. Church whose adherents practised flogging themselves or one another as a means of disciplining the flesh and promoting spiritual growth. They arose in Italy in the 13th century, and continued to break out sporadically for about 150 years. One of their chief leaders was Cardinal Peter Damiani, who taught that a vigorous scourging was worth many years of ordinary self-denial and mortification. In 1260 there was a great outbreak of this form of fanaticism at Perugia, and in the following century it caused trouble in Germany and Hungary.

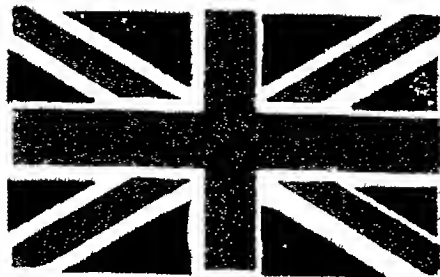
When the Black Death swept over Europe in 1348, the Flagellants had a great revival, and held processions through the streets stripped to the waist and singing penitential psalms. A halt was called at intervals, and all scourged one another in turn. About 120 of these enthusiasts reached London,



Flag. Yellow Flag, *Iris pseudacorus*, showing the tall sword-like leaves; top, flower of *Iris foetidissima*



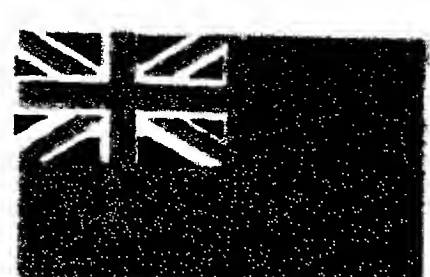
ROYAL STANDARD



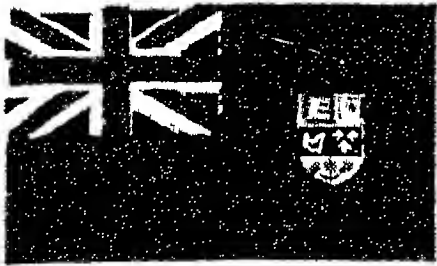
UNION JACK



WHITE ENSIGN (Royal Navy)



RED ENSIGN (Merchant Navy)



CANADA



AUSTRALIA



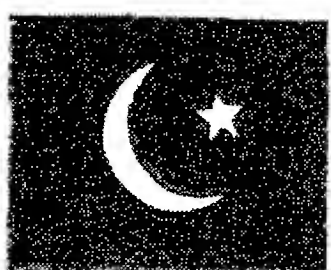
NEW ZEALAND



UNION OF SOUTH AFRICA



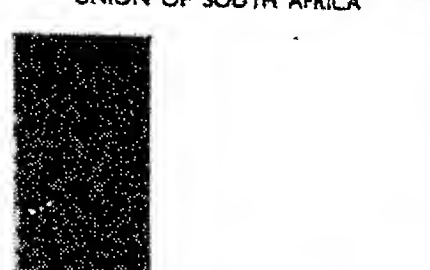
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PAKISTAN



CEYLON



IRISH REPUBLIC



FRANCE



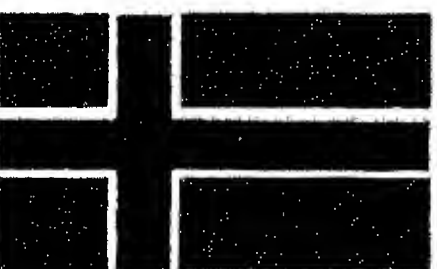
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NETHERLANDS



LUXEBURG



NORWAY



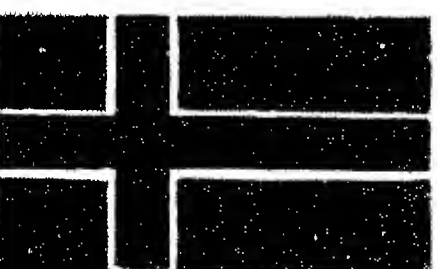
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DENMARK



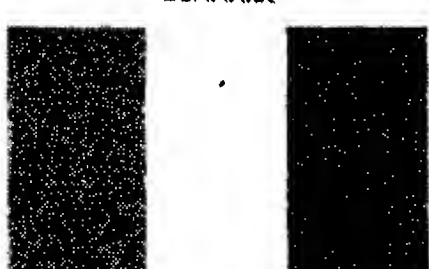
FINLAND



ICELAND



SWITZERLAND



ITALY



GREECE



PORTUGAL



SPAIN



HUNGARY



AUSTRIA



CZECHO-SLOVAKIA



ALBANIA



RUMANIA



BULGARIA



YUGOSLAVIA



POLAND



RUSSIA



TURKEY

FLAGS OF THE NATIONS : BRITISH COMMONWEALTH AND EUROPE



ISRAEL



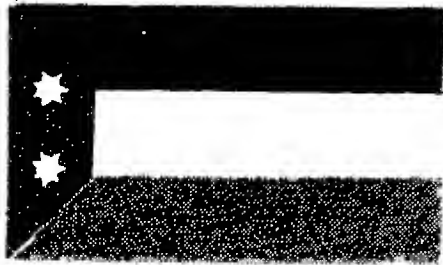
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SYRIA



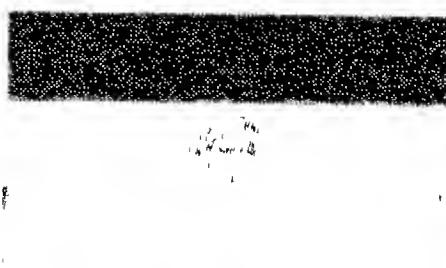
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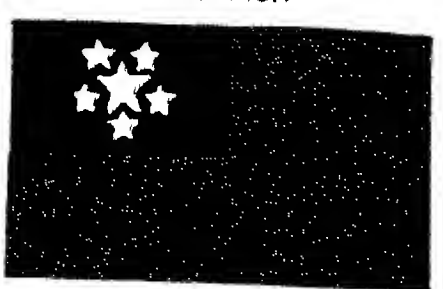
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SAUDI ARABIA



PERSIA



BURMA



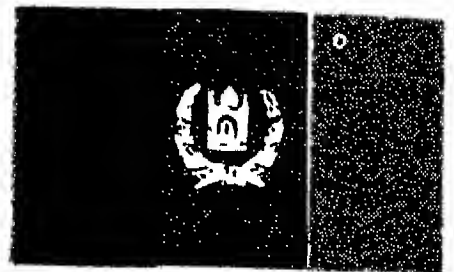
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CHINA



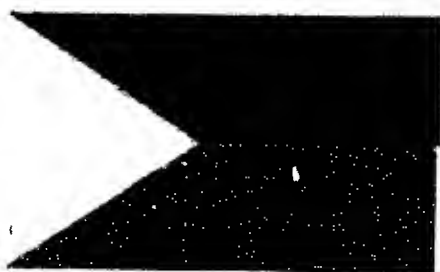
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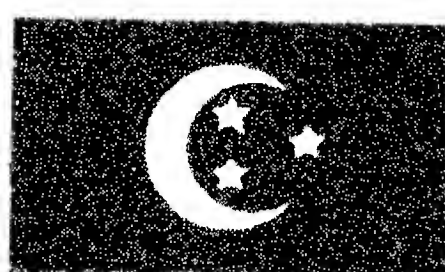
AFGHANISTAN



INDONESIA



PHILIPPINES



EGYPT



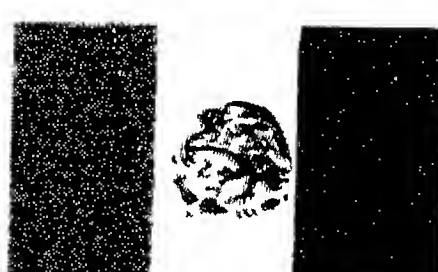
ABYSSINIA



LIBERIA



UNITED STATES OF AMERICA



MEXICO



GUATEMALA



HONDURAS



NICARAGUA



COSTA RICA



PANAMA



DOMINICAN REPUBLIC



HAITI



COLOMBIA



VENEZUELA



ECUADOR



PERU



BRAZIL



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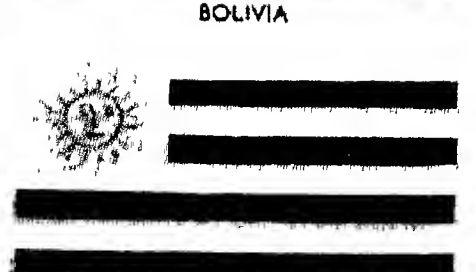
PARAGUAY



CHILE



ARGENTINA



URUGUAY

FLAGS OF THE NATIONS: ASIA, AFRICA, AND THE AMERICAS

See over]

To face page 3393

but won no followers in England. They were denounced by Pope Clement VI, and finally suppressed by the Inquisition.

Flagellata OR MASTIGOPHORA. Sub-division of the protozoa. Found in stagnant water, they have "whiplike" threads of protoplasm which by their lashing movements propel the animal through the water.

Flagellum. A filamentous protoplasmic outgrowth arising singly or among a few of its kind from the surface of a cell in which a basal granule occurs near the point of attachment. The reciprocating or spiral movement of a flagellum, unlike that of a cilium, is independent of the motion of any other structure of the same kind which may be present, but similarly induces relative or actual movement in the liquid into which it projects. Both flagella and cilia may possibly be sensitive to contact stimuli.

Flageolet (Fr.). Wind instrument of flute tone, played vertically through a mouth-tube. The modern instrument has a separate mouthpiece, but those of the 17th century had the blowing hole on a sloped end of the main tube, like the present-day penny whistle. The true 17th century flageolet had two of its six finger-holes at the back; these were governed by the player's thumbs. See Recorder.

Flag Lieutenant. Lieutenant in the Royal Navy appointed to act as aide-de-camp to an admiral, and usually a specialist in signalling. His insignia consists of the aiguillette or golden cord on his left breast.

Flag Officer. Naval officer of the rank of rear-admiral or above who is entitled to hoist a flag on board ship to denote his command. There are four grades of flag

officer in the Royal Navy: rear-admiral, vice-admiral, admiral, and admiral of the fleet. The flags are: rear-admiral's, S. George's cross with two red balls, flown at the mizzen; vice-admiral's, S. George's cross with one red ball, flown at the foremast; admiral's, S. George's cross, flown at the mainmast; and admiral of the fleet, Union Jack. They are derived from the banners which were flown on board ship in the days when generals held the principal commands at sea. A commodore or other senior officer below the rank of rear-admiral flies a pennant or burgee when in command of a squadron.

Flagship. Vessel in which a flag officer is accommodated, and in which he flies a distinctive flag to indicate the ship to which others must look for signals. A single fleet may have many flagships, according to the number of its tactical units. The tactical unit is a division of four ships, usually with a rear-admiral in command; and two divisions make a squadron, over which is a vice-admiral, who also has charge of one of the two divisions. A number of battle squadrons, with their attendant craft, make up a fleet, the commander-in-chief, as a rule, flying his flag in a vessel which is outside the divisional formation, and at liberty to place herself where she chooses.

At the principal home naval stations the flag of the local commander-in-chief is flown in an old warship, i.e. the Victory at Portsmouth, the Impregnable at Devonport, the Pembroke at Chatham, and the Crescent at Rosyth, but the officer lives in an official residence ashore. Most of the senior departmental officers in flagships, i.e. those chosen for staff, gunnery, torpedo, navigation, or engineering duties, receive a special flag allowance in addition to their pay. Vessels that are not flagships are sometimes called private ships. See Battleship; Navy.

Flagstaff. City of Arizona, U.S.A., the co. seat of Coconino co. Situated at an altitude of 6,907 ft., it is on the main line of the Atchison, Topeka, and Santa Fé rly. and has an airport. It is in an area of national parks, forests, and monuments, Indian reservations, and sheep and cattle ranches, and is the centre for tourists visiting the Grand Canyon, Painted Desert, Petrified Forest, etc. Flagstaff trades in livestock and lumber. Dry farming is carried out in the surrounding

country. First settled by white men in 1876, it was incorporated as a city in 1928. At the census of 1950 Flagstaff had a population of 7,663.

Flagstone. Fine-grained argillaceous sandstone, which splits easily in slabby fashion along the bedding plane. Fine sandstones which do not show this so-called lamination are sometimes included under the same name. Flagstones are composed mainly of minute grains of quartz, but generally contain also some feldspathic and micaceous material. The colour of flags varies from almost white to grey or yellow; while the mica flakes, if present, give the stone a sparkling appearance in the sunlight. Their fine, even texture, their strength, and the readiness with which they break into blocks of convenient size make them suitable for use as building stones.

Flagstones are mainly used, however, for paving-stones, kerbstones, hearths, sills, and steps, and those varieties which split into very thin layers, for roofing.

Flaherty, ROBERT JOSEPH (1884-1951). American film director. Born in Michigan and educated at Upper Canada College, Toronto, he led four expeditions into subarctic eastern Canada, explored and mapped the archipelago known as Belcher Islands, Hudson Bay, and also the unknown lands of N. Ungava. In 1920 he entered the film industry, later producing *Nanook of the North*, a picture dealing with the Eskimos of Hudson Bay. Then he made *Moana*, a study of the Samoan Islands. His finest films included *Tabu* (1929-31); *Man of Aran* (1932-34); *Elephant Boy* (1935); *The Land* (1939-41), made for the U.S. department of agriculture. He died July 23, 1951.

Flail (Lat. *flagellum*, little whip). A hand implement for threshing. It is now little used in the U.K., except on a small scale for flax or when separating peas and beans for seed. It is still in use in e.g. Italy. It consists of a shaft or handle, commonly made of ash, and a swingle (swiple) of some hard, non-splitting wood. The two are fixed together so that the swingle can move freely, this being effected either by leather thongs or by interlocking an ash swivel on the shaft with a leather loop on the swingle.

Flak (German *FLieger-Abwehr-Kanone*, cannon against aircraft). Anti-aircraft fire; specifically, the actual projectile and its fragmentation after exploding. During the



Flageolet. Left, 17th century instrument; the open circles show thumb positions at back of tube. Right, modern flageolet with four keys

Second Great War the term flak was at first used by R.A.F. crews in reference to "flaming onions," German incendiary shells fired in bursts and resembling a string of onions. Later the word indicated any A.A. fire, friendly or hostile.

A flak ship was a small German craft mounting anti-aircraft guns, used in the Second Great War to protect small coastal convoys or ships in harbour.

A flak tower (Ger. *Flakturm*) was a concrete tower mounting heavy and light A.A. guns, built by the Germans for the defence of cities and other specific targets. Some flak towers in Berlin were over 100 ft. high and had at their base public air-raid shelters. Similar towers, but constructed of steel, mounted on caissons, and grouped in fives connected by catwalks, were set up in the Thames estuary for the protection of ships assembling for convoy. These mounted heavy and light A.A. artillery and were jointly manned by the R.N. and the R.A. They were retained after the Second Great War and manned by army maintenance parties.

Flambard, RANULF OR RALPH (d. 1128). The chief minister of William Rufus. Son of a Norman priest, he was made chaplain to the bishop of London, and after William II's accession became his principal adviser, especially in financial matters. In 1099 he was made bishop of Durham. He incurred unpopularity by his extortionate fiscal methods, and after the death of Rufus was imprisoned, but escaped to Normandy, where he became bishop of Lisieux. He returned to England in 1106, after the battle of Tinchebrai.

Flamborough Head. A promontory on the E. coast of Yorkshire, England, forming the N. arm of Bridlington Bay. The chalk cliffs, rising to 450 ft., are pierced by a number of caves, and the action of the sea has fashioned the rocks into fantastic shapes. The cliffs are a breeding place for innumerable sea birds, and the collection of eggs in late May and early June is a traditional and perilous local industry, especially in the neighbourhood of Speeton and Bempton, to the N. The lighthouse is 214 ft. above sea level,



Flamborough Head. Promontory on the E. Yorks coast, with chalk cliffs rising to 450 ft.

and its revolving light is visible for 21 m. Flamborough village, largely inhabited by fishermen, is some miles inland. The neighbourhood of the lighthouse has been greatly marred by the indiscriminate building of small houses and bungalows.

Flamboyant (Fr., flaming). In architecture, a development of late French Gothic. It owes its name to the flame-shaped openings in tracery which were its chief characteristic. The period of Flamboyant was the late 15th and early 16th centuries. The style hardly penetrated to Great Britain, though some of the flowing tracery in Chester cathedral approximates to it. Among French examples are the church of S. Maclou at Rouen, and part of Tours cathedral.

Flame. Gaseous matter raised to a temperature at which it becomes self-luminous, as a result of combustion. Some gases inflame spontaneously because the ignition temperature is as low as the ordinary temperature of the air. Examples are cacodyl, phosphorus dihydride, and zinc ethyl. As a rule, however, the temperature of the gas must be raised before the chemical reaction with the oxygen of the atmosphere takes place. An agency which lowers the temperature below ignition point puts out the flame: a copper helix placed in a candle flame extracts heat so rapidly that the flame is extinguished.

This cooling action is used in the Davy miners' safety lamp, where the wire gauze prevents the flame from being communicated to the inflammable fire-damp in the mine. It has long been known that ordinary flames are hollow and that

there are "solid" flames where the complex molecule of a gas is by combustion broken up into simpler forms, e.g. in burning nitrogen trichloride. Berzelius pointed out that a candle or hydrocarbon flame shows four distinct regions: (1) the dark central region, (2) the yellow region, (3) the blue region, and (4) the faintly luminous portion. The dark portion consists of unburnt gases, whilst the yellow portion occupying the greatest part of the flame is the luminous portion.

The temperature of a flame depends upon the heats of combination of the constituents and the specific heats of the products of the combination. The temperature of sulphur burning in air is comparatively low, whereas an oxy-acetylene flame reaches 2,500° C. Oxidation of substances like phosphorus may give rise to chemiluminescence at low temperatures, and thus to cool flames. The colour of a flame is not as a rule indicative of the calorific power. The yellow gas flame is converted into a hotter non-luminous flame by the admixture of air, such burners, known as Bunsen burners, being used for heating operations in the laboratory and the kitchen.

A sensitive flame is a gas flame produced by a pin-hole burner in which the pressure of the gas has been increased till it is on the point of flaring. This long, thin flame is a sensitive detector of sound waves, particularly of those of high pitch and tiny amplitude. When a train of these sound waves impinges on the sensitive flame it flares and suddenly shortens. See Fire; Heat.

Flame Cell. A specialised cell found in many flat-worms (*Platyhelminthes*). It is hollow and is provided with cilia on the inner surface. Excretory products are collected by the cell, passed into its cavity, and wafted down by the cilia to other drainpipe-shaped cells which, joined end to end, provide a passage to the outside. Its name is derived from the flickering motion of the cilia which, seen under a microscope, somewhat resembles the flickering of a flame.

Flame-flower OR RED-HOT POKER (*Kniphofia uvaria*). Perennial herb of the family Liliaceae. It is a native of S. Africa. The leaves, which grow in a compact tuft from the root, are long, narrow, and of tough consistency; they are channelled above and keeled below, the keel and the edges finely toothed. The brilliant



Flame-flower or Red-hot Poker

red, tubular flowers are disposed in a close oval spike, at the summit of a stem 3 ft. or 4 ft. high. The aspect of the flowers gives the herb its descriptive name.

Flamen. In ancient Rome, a priest devoted to the service of a particular god. The chief of these priests, who had to

belong to the patrician order, was the flamen Dialis or priest of Jupiter. Not only the flamen Dialis himself, but his wife, who was called Flaminica, and the whole household were regarded as consecrated to the god.

Flame Weapon. Reservoir of inflammable oil which can be thrown to a distance in the form of a spray of fire. The oil is forced through a nozzle by means of gas or compressed air contained in a subsidiary reservoir and is ignited by a trigger-controlled device fitted to the end of the nozzle. Flame has been utilised as a weapon of war from ancient times. The Greeks had their Greek Fire, and as early as 250 B.C. the Romans devised containers of chemicals which were catapulted amongst enemy troops and ignited into flame upon contact with the ground. A common form of defence was to instal containers of chemicals in front of static military positions and ignite them in the path of advancing troops.

With the development of firearms, flame weapons gradually fell into disuse. They were revived in the First Great War when the Germans introduced the *Flammenwerfer*, a type of blow-lamp originally intended for cutting paths through barbed wire by melting the strands. During the attack on Hoge in 1916 the weapon was used against infantry, and subsequently it was used in trench fighting. Similar flame-throwing equipment was later adopted by the Allied armies. The largest type of flame-thrower held nearly 350 pints of oil, and the smallest 16 pints. A special device was installed on one of the British ships in the raid on Zeebrugge.

Germany continued the development of flame-throwers and

used them in large numbers when she invaded Poland in 1939 and France in 1940. She introduced the tank flame-thrower, pressure from the engine giving the jet, which had a temperature of 2,000° C. and a range of 100 yds. Italy had flame-throwers mounted on Ansaldo tankettes. Russia installed them in the modified 6-ton tank which she used against the Mannerheim line in the Russo-Finnish campaign of 1939-40.

The British army had no flame-throwers in France in 1940, but shortly after the evacuation of the army from Dunkirk there was formed a petroleum warfare department to develop the application of these weapons, chiefly as a

flame traps; these consisted of perforated pipes laid down each side of a coastal gap and fed from underground reservoirs so that burning oil could be sprayed over the whole area.

A development of the old-time fougasse, or mine, which discharged oil instead of metal, and a hedgehog fougasse which could be hidden behind a wall or rise in the ground and electrically fired to jump over it and burst into flame, were used in conjunction with the anti-tank traps dug throughout Great Britain. When erected vertically, these weapons projected a flame 200 ft. into the air, and when laid along the ground shot blazing oil to 150 ft.

at a temperature of 1,500° C. For the defence of aerodromes, a flame-throwing armoured car was developed; it projected flame vertically or along the ground. The Germans took such a serious view of these weapons that many troops training to take part in the invasion were equipped with asbestos suits.

In 1942 the petroleum warfare department began experimenting in the design of mobile flame-weapons for the eventual Allied invasion of the Continent. No hint of possession of these weapons was allowed to escape until D-day, when they burned and blasted their way through the defence. The heaviest of them was the Crocodile. The nozzle and controls were mounted in a



Flamen. Members of the College of Flamines, from the Altar of Peace set up in Rome by Augustus
Uffizi Gallery, Florence

defensive measure against the threatened German invasion. A "sea flame barrier" was set up at vulnerable points on the S. coast by piping oil out to sea beyond the low tide mark to form surface pools that could be fired by passing through the pipes a chemical which ignited on contact with sea water. Gaps on rocky parts of the coast were protected by defile

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Flame Weapon. The Crocodile, a flame-thrower fitted to a Churchill tank, firing low to obliterate an objective



Flame Weapon. Wasp flame-throwers attacking in line abreast, risking the danger from one another's flame jets

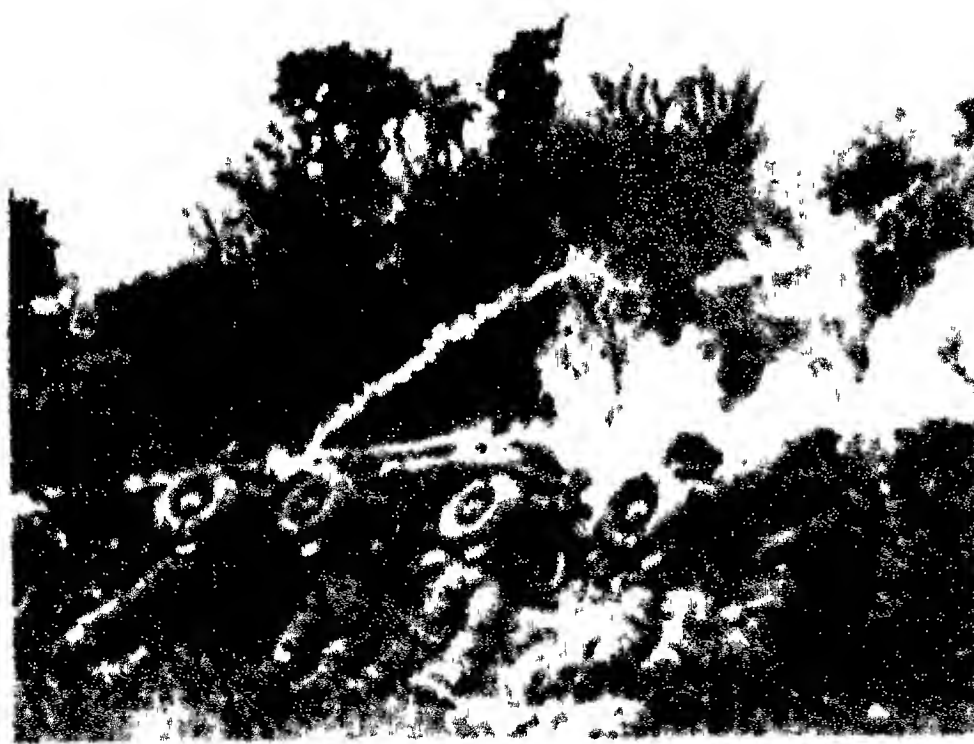
Churchill tank, and the fuel was carried in an armoured trailer and transferred to the tank at a pressure of 300 lb. per sq. in. through an armoured pipe incorporated with the towing link. The link made it possible for the trailer to be towed over any ground that the tank would travel over. The jet had a range of nearly 200 yds.

For close infantry support, the Wasp was evolved. With a range of 150 yds., it was fitted to a standard Bren carrier, the fuel and compressed gas tanks being also carried thereon. Projectors and tanks were easily removable, should it be necessary for the carrier to resume its normal rôle. The Lifebuoy flame-thrower was an infantry weapon, carried into action on a man's back. It had a ring-shaped container for the fuel and a spherical container for the compressed gas. The flame was projected from a hand-gun which incorporated an igniting mechanism. The Lifebuoy had a range of 70 yds. and was frequently used by parachute troops. These three British flame-throwers could fire round corners, as the fuel ricocheted

and produced fierce fires in nooks and corners of pill-boxes and trenches. Apart from their capacity for physical devastation, they had a powerful psychological effect. See also Incendiary Weapons.

Flamingo (*Phoenicopterus*). Order of large birds, nearly related to the ducks. They have extremely long legs and necks, rosy or scarlet plumage with black on the wings, and beaks sharply bent down at an angle. Adult specimens sometimes exceed 6 ft. in height. One European species, four or five American, and one African are known.

Flamingoes are wading birds, as their long legs and necks suggest, and are found in great flocks by the margin of lakes and rivers, feeding on molluscs and aquatic vegetation. When feeding, the flamingo's head is turned upside down and the curved beak acts as a scoop for picking up food. The birds are fairly strong in flight, and can swim well. The nests are made of mud, and when built on land rather resemble large soap plates. When constructed in the water, they are tall and conical. The European flamingo is common in the S. of France and in Spain during the nesting season, and it ranges through many parts of Africa. It is rarely seen in Great Britain. The name is from Span. *flamenco*, derived from Lat. *flammeus*, flame, in reference to the bird's colour.



Flame Weapon. Troops equipped with Lifebuoy flame-throwers attacking the enemy concealed behind a hedge

Flaming Onions. Incendiary shells used primarily with a view to setting aircraft on fire. The incandescent projectiles are strung together and resemble a string of glowing onions.

Flaminian Way (Latin: *Via Flaminia*). The great north road of ancient Rome. It took its name from Gaius Flaminius, censor in 220 B.C., and ran from Rome to Ariminum via Narnia and Spolegium. It started near the Capitol and crossed the Campus Martius along the line followed by the modern Corso, passing through the Porta Flaminia of imperial times and crossing the Tiber by the Milvian bridge (*Pons Mulvius*).

Flaminius, Titus Quinctius (d. c. 175 B.C.). Roman general. Before he was 30, he attained the consulship, and in 197 B.C. defeated the Macedonians at Cynoscephalae (*q.v.*). A clever diplomatist and an



Flamingo. Adult specimens of the European flamingo

admirer of the Greeks and their culture, he was appointed to settle the affairs of that country. At the Isthmian games in 196 he proclaimed amidst great enthusiasm the independence of Greece, really the exchange of a Roman for a Macedonian master. After crushing the Spartan tyrant Nabis, he was honoured by a splendid triumph on his return to Rome in 194. In 192 he was again in Greece and prevented the pro-Syrian party from assisting Antiochus in his struggle against Rome. In 183 Flaminius was sent to demand the surrender of Hannibal from Prusias, king of Bithynia.

Flaminius, Gaius (d. 217 B.C.). Roman statesman. He introduced an agrarian law in 232, providing for the distribution of recently conquered territory in Picenum and Senonian Gaul among the plebeians. During his censorship

in 220 he built the great Circus Flaminius and extended the Flaminian Way (*q.v.*). He was one of the generals in command of the Roman army at the battle of the Trasimene lake in 217, in which he was slain.

Flammarion, CAMILLE (1842-1925). French astronomer. Born Feb. 25, 1842, at Montigny-le-Roi,



Flammarion

he studied theology at Langres and Paris. In 1858 he entered the Paris observatory, and was a member of the Bureau des Longitudes in 1862. From 1863 he edited *Cosmos* and *L'Astronomie*. He carried out numerous observations, especially on Mars, at his private observatory at Juvisy. He won wide fame as a popular writer on astronomy, and founded the astronomical society of France in 1887. Among his books translated into English are: *Popular Astronomy*; *Astronomy for Amateurs*. He died June 4, 1925.

Flammenwerfer. The German name for a type of flame-thrower first used at Hooze in 1916. See *Flame Weapon*.

Flamsteed, JOHN (1646-1719). An English astronomer. Born at Denby, Derbyshire, Aug. 19, 1646, he was educated at Cambridge. From 1684 he held the benefice of Burstow, Surrey. Devoting himself early to the study of astronomy, he was appointed king's astronomer in 1675, with an annual salary of £100, and installed eventually at the new Greenwich observatory, begun in that year. His observations there gave Newton much help in the perfecting of his lunar theory, though there was much ill-feeling between the two men. Flamsteed's chief work was the great catalogue of the fixed stars, the origin of all later catalogues, which was incomplete at his death on Dec. 31, 1719, but was published with his other observations in 1725. This work was edited by F. Baily, 1835.

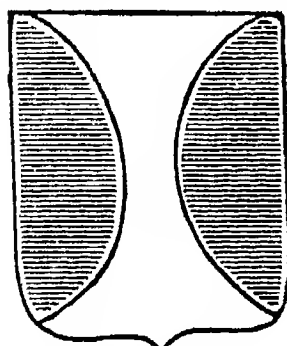


John Flamsteed

Flanagan and Allen. British music-hall comedians. Robert Winthrop (who adopted the name of Bud Flanagan), born Oct. 14,

1896, and (William Ernest) Chesney Allen, born April 5, 1894, first appeared together in a revue entitled *Us* in 1926. They evolved a type of verbal humour which found full scope in the *Crazy Gang*—an entertainment first given in 1931. Allen retired from the act in 1946. They also wrote and sang sentimental songs, of which *Underneath the Arches* was typical.

Flanches OR **FLANQUES**. In heraldry, the dexter and sinister sides of a shield cut off by curved lines, giving the middle an hour-glass form. They are usually borne in pairs, and are classed among the sub-ordinaries (*q.v.*).



Flanches, in heraldry

Flanders. That part of the Low Countries which is bounded roughly by the lower reaches of the river Scheldt, the Lys valley, and the coast from Calais to the Scheldt estuary. The political frontiers of Flanders have varied considerably, but most of this territory now lies in Belgium, and the old name is retained in the two provinces of W. Flanders (*Flandre Occidentale*), and E. Flanders (*Flandre Orientale*). The Flemish provs. are markedly different in character from the Walloon provs. of Belgium, being mainly peopled by peasants speaking Flemish, a branch of the Dutch language (when written, it is the same).

That part of the Netherlands between the Scheldt estuary and the Belgian frontier is called Zeeland Flanders; and the French dept. of Nord, contiguous with the old French province of Flanders, remains very Flemish in character. The chief towns of W. Flanders are Bruges, Courtrai, Ostend, Roulers, Mouscron, Thielt, Furnes, Ypres, Dixmude; of E. Flanders, Ghent, Alost, Audenarde, Eecloo, St. Nicholas, Termonde. W. Flanders, area, 1,248 sq. m.; pop. est. 1,010,000. E. Flanders, area, 1,147 sq. m.; pop. est. 1,231,000.

The Romans conquered the then inhabitants of modern Flanders, the Menapii and the Morini, about 51 B.C. During the 7th century Christianity was introduced, chiefly by S. Bertinus, S. Omer, and S. Bavon. The treaty of Verdun, 843, by which Charlemagne's three grandsons partitioned his empire among themselves, gave most of Flanders to Charles the Bald of the W. Franks. Finding this part of

his dominion constantly harassed by the Northmen or Normans, he entrusted its defence to Baldwin Bras-de-Fer (Iron-Arm), who founded the historic line of the counts of Flanders. The last of the direct line, Baldwin VII, died in 1119, and Flanders passed to his cousin Charles, called the Good.

In 1157 Count Thierry resigned in favour of his son Philip, who ruled with marked success, being largely responsible for the early economic prosperity of the great Flemish market towns of Bruges, Ypres, Ghent, etc., and who died crusading at Acre, 1191. He left his Flemish dominions to his sister Margaret of Hainault, who thus united the crowns of Flanders and Hainault, though ceding Artois to Philip Augustus of France. Her son, Baldwin IX (1171-1205), emperor of Byzantium, succeeded her in 1194. His daughter, Joanna, was married to Ferdinand of Portugal, who resisted the suzerainty of France, but was disastrously defeated by Philip Augustus at Bouvines, 1214.

After Joanna's death, 1244, the kingdoms of Flanders and Hainault were torn by a war of succession, and were eventually separated by the arbitration of S. Louis, who awarded Flanders to William of Dampierre, and Hainault to his stepson, John of Avesnes, 1246. Guy of Dampierre, who succeeded in 1280, waged war, in alliance with Edward I of England, against Philip the Fair of France. Supported by popular feeling, directed by the Flemish patriots, Deconinck and Breydel, he routed the strong force of French knights near Courtrai, 1302, and for a time Flanders was definitely free from France. But under Louis of Nevers, 1322-46, it was again virtually a French fief.

Resistance to French Rule

The following period of internal dissensions was marked chiefly by the resistance of the Flemish communes to the arbitrary and extortionate rule of Louis II of Mâle, who succeeded in 1346. John and Philip van Artevelde (*q.v.*) hold a great place in Flemish history as spokesmen and leaders of the popular party, or White Hoods. By the autumn of 1382 Philip had become very powerful in W. Flanders, established in Bruges, and assured of the people's support. But at Roosebeke, Nov. 27, 1382, he was utterly defeated by Louis with the aid of Charles VI of France. Thenceforth Louis ruled with a firm hand until his death, 1385, when Flanders fell to

his daughter Margaret, wife of Philip the Bold of Burgundy.

Flanders remained part of Burgundy until in 1477 the marriage of Mary of Burgundy to the emperor Maximilian brought it into the possession of the house of Austria. In the period that followed, the great Flemish towns enjoyed their highest prosperity. In 1555, the emperor Charles V passed the overlordship of Flanders to his son Philip (to whom in 1556 he also passed his Spanish possessions). The ensuing wars of independence wrecked Flemish prosperity.

The treaty of Westphalia, 1648, recognized the freedom of the United Provinces, including Zeeland Flanders; the rest of Flanders, which had been reconquered by Spanish arms, remained in the possession of the Spanish crown until the treaty of Utrecht, 1713, gave it to the house of Austria, which lost it to France in 1794. French occupation ended in 1814, and all Flanders was part of the kingdom of the Netherlands until the recognition in 1839 of the kingdom of Belgium, which included former Austrian Flanders.

Neither these many changes of sovereignty, nor the unfortunate position of Flanders as a battlefield of the nations, has destroyed the individual character of the Flemings and their country. Within Belgium, language consciousness is sharp, and the Flemish movement in favour of autonomy has considerable strength. It has won recognition of Flemish rights, linguistic and educational, and is an important factor in Belgian politics.

Flanders, BATTLE OF. Name given to one of the final battles of the W. front in the First Great War which brought about the military defeat of Germany by the Allies. It was fought Sept. 28–Nov. 11, 1918. The heavy fighting in Flanders in 1914, sometimes called the 1st battle of Flanders, is more generally known under the titles Ypres and Yser. In the Second Great War, the Allied campaign in Flanders of May, 1940, which ended in the retreat upon Dunkirk, was also described as the battle of Flanders in the title of a popular semi-official account published the following year, but is dealt with in this work under British Expeditionary Force.

In 1918, in accordance with the general plan of Foch, the Allied c.-in.-c., a group of Belgian, British, and French armies was

placed under command of the king of the Belgians, and opened an attack on a front extending from Dixmude to the S. of the Ypres salient on the morning of Sept. 28. In spite of heavy rain, by Oct. 1 all the German main defensive line on the Flanders front was penetrated to a depth of over 8 m. The Germans at once began preparations for the evacuation of the Flanders coast, which they had at one time decided to annex permanently.

After a pause for reorganization the Allies resumed the attack on Oct. 14; and a slow German retreat along the whole front continued up to the date of the armistice, Nov. 11. The Allied troops had to march and fight with German rearguards in difficult country with bad communications. Mines with delay-action fuses were left by the Germans at every cross-roads and at many points on the railways, and these exploded sometimes weeks after their retirement. In the first phase of the battle some 10,000 German prisoners were taken; in the second phase, some 18,000.

Flanders Poppy. Artificial flower sold on Remembrance Day, originally Nov. 11 (sometimes called Poppy Day) to support Earl Haig's appeal fund for disabled ex-Servicemen. The scarlet wild poppy grows in such profusion in Flanders that it was chosen as the commemorative emblem of this fund, which was founded to aid ex-servicemen of the First Great War. See Armistice Day.

Flandin, Eugène Napoléon (1809–76). French painter. Born in Naples, Aug. 15, 1809, he studied in Italy, and under Horace Vernet in Paris, and travelled widely in the East. He painted many landscapes, notably of Venice, Athens, Algiers, and Constantinople, and wrote valuable accounts of his travels and archaeological discoveries. He was awarded the Legion of Honour in 1842, and died Feb. 15, 1876.

Flandin, Pierre Étienne (b. 1889). French politician. He was born in Paris, April 12, 1889, educated at its university, and entered the legal profession. In 1914 he was elected deputy for Yonne, and later held many cabinet appointments, being prime minister in 1934–35 and foreign minister in 1936. Of the moderate Right and with industrial and financial connexions, he worked for a rapprochement between France and Germany and was in favour of terminating the alliance with Great

Britain. After the capitulation of France in June, 1940, Flandin retired to the German-occupied



P. E. Flandin,
French politician

area, but in Dec. was appointed foreign minister in the Vichy government. He resigned Feb. 9, 1941. Arrested in Algeria, Oct. 8, 1944, he was interned in Fresnes prison, near Paris, and on March 1, 1945, the high court ordered the sequestration of all his property. In 1946, Flandin was found guilty of "national indignity" by participating in the Vichy government and was sentenced to five years' loss of civic rights; but was at once exonerated in view of his past services to the resistance movement.

Flandrin, Jean Hippolyte (1809–64). French painter. Born at Lyons, March 23, 1809, son of a miniature painter, he studied there and at Paris under Ingres (*q.v.*). Obtaining the Grand Prix in 1832, he went to Rome, whence he returned in 1838 to Paris, and was employed in the mural decoration of S. Séverin, 1841, S. Vincent-de-Paul, 1850, and other churches at Paris and elsewhere. Later he took to portrait-painting, among his best works in this genre being the full-length portrait of Napoleon III, at Versailles. He died of smallpox at Rome, March 21, 1864.

Flandrin, Jean Paul (1811–1902). French painter. A brother of J. H. Flandrin, he was born at Lyons, May 8, 1811, and studied under Ingres. He was a prolific artist, his best work being of landscapes. Among the most noteworthy are *Solitude in the Sabine Mountains*, 1852, in the Luxembourg, Paris; *The Rhône*, 1857; *Meadow near Mantua*, 1874; and *Diggers at Work*, 1884. He was awarded the Legion of Honour in 1856, and died March 10, 1902.

Flange. A projection which guides, strengthens, or affords a means of attachment. Flanges are used for a number of purposes, the designs taking many forms. To prevent lateral movement of a belt or rope the wheels over which it runs are often provided with circumferential flanges. A similar method is adopted for wheels running on rails, with the important difference that it is the travelling member which is flanged. Flanges may also be suitably positioned, to

give additional strength to steel beams and girders. A further purpose is that of joining two individual members of a structure, *e.g.* water and gas pipes. In railway wheels the flanges are forged to shape, but for the production of girders or beams they are formed by hot rolling between rolls. Casting is a third method used in the production of the component itself, *e.g.* flanges on cast iron pipes.

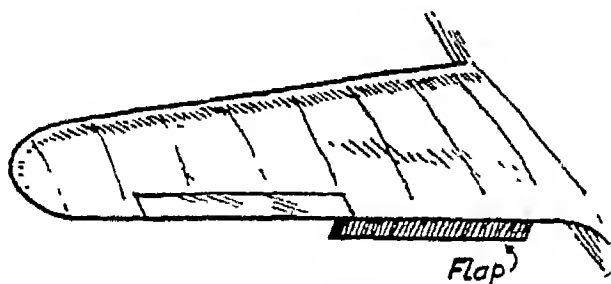
Flank. Military term used for the side of a unit, whether in column, line, mass, or any other formation. On the march troops are protected by flank guards, and when taking up a position by outposts, unless the nature of the ground makes an attack impossible. *See* Tactics.

Flannan Isles. Cluster of seven small islands in the Outer Hebrides, Ross and Cromarty, Scotland. Called also the Seven Hunters, they lie 16 m. W.N.W. of Gallon Head, Lewis Island, and contain many Caledonian remains. They are the *Insulae Sacrae* of Buchanan. Large numbers of sea-fowl frequent them. Flannan Isle is the title of a poem on the supernatural by Wilfrid Gibson.

Flannel. Soft woollen cloth used for clothing, blankets, etc. Highly absorbent, it is eminently adapted for wearing next the skin. The word is probably of Celtic origin (*cf.* Welsh *gwan*, wool). Wales is the original home of the flannel industry, and has long held flannel fairs. Falstaff calls Sir Hugh Evans the "Welsh flannel." Welshpool, Montgomeryshire, formerly the chief seat of the manufacture, has been superseded by Newtown. Lancashire and Yorkshire are noted for flannels, particularly Rochdale. *See* Blanket.

Flannelette. Cotton imitation of flannel, used for pyjamas, underwear, etc. The term was first used towards the end of the 19th century. Flannelette has lost much of its former popularity as it lacks the absorbent properties of flannel, and is liable to catch fire.

Flap. Device fitted to aircraft wings to enable high-speed machines to land on constricted aerodromes. Flaps are fixed to the trailing edge of the wing and are hinged to move downwards. When down they offer resistance to the air and so act as a brake upon forward movement. In normal flight the flaps are kept in the same plane as the wing surface and are controlled by a lever in the cockpit. Dive-bombers are fitted with large flaps to check downward momentum during the dive (*see* Divo



Flap fitted to aircraft wing

Brake). By a combination of flaps and slots, the slots being fitted to the leading edge of the wing, a high-speed aircraft can be flown safely at remarkably low speeds. The slots smooth out the airflow over the upper surface of the wings, while the flaps give an increase in lift.

Flare. Fireworks of the nature of coloured fires. They were used during the Great Wars and in later operations, *e.g.* in Greece, to illuminate portions of the front at night, and sometimes arranged so that they were automatically ignited if anyone moving about stumbled over a trip wire placed in front of the position. Screens were arranged behind the flares so that the enemy troops were illuminated, while their opponents remained in the shadow and were not inconvenienced by the light. Small hand flares of the Very light (*q.v.*) type were used for both illumination and signalling, and generally burned for about three minutes. Larger ones were thrown from trench howitzers. During the Second Great War flares were dropped from aircraft by parachute to illuminate targets during bombing attacks. Flares intended to illuminate the ground usually contained a mixture of powdered magnesium and a chlorate or nitrate of one of the alkali metals. They gave an intense white light, throwing strong shadows. Life-buoys usually have attached to them a canister of chemicals which automatically ignite on contact with water and emit a bright yellow flare. Signal flares of various colour are obtained from such constituents as the following, combined in the proportions shown.

	Red	Green	Blue	Yellow
Potassium chlorate ..	78	—	45	—
Strontium carbonate ..	15	—	—	—
Shellac ..	7	1	5	—
Barium chlorate ..	—	66	—	—
Milk sugar ..	—	33	—	—
Sodium nitrate ..	—	—	—	70
Sulphur ..	—	—	—	20
Antimony sulphide ..	—	—	—	7
Lampblack ..	—	—	5	3
Basic copper carbonate ..	—	—	10	—
Calomel ..	—	—	35	—

Flare Path. Lights set along the edge of a runway or laid out to form a path on an airfield to enable aircraft to land at night. On permanent runways the lights are set flush in the ground on either side of the tarmac and lit electrically. On temporary airfields the flare path is lit by portable oil lamps. It is always lit or laid out so that the pilot comes in to land into the wind, coloured lights giving him his direction.

Flash. Piece of broad black silk ribbon with long ends, which is attached to the back of the tunic collar of the Royal Welsh Fusiliers. This is a relic of the days when soldiers wore their hair powdered and tied in a queue; the flash served to keep grease from soiling the back of the tunic. During both Great Wars the term flash was applied to the strips of printed or embroidered or coloured material worn on the shoulders of army tunics or blouses to denote regiments and formations. Dominion servicemen and Allied subjects serving with the British services in the Second Great War wore shoulder flashes indicating their dominion or nationality. Flashes worn by civil defence personnel denoted their particular functions.

Flash. Distinctive emblem worn by the Royal Welsh Fusiliers

The term is also used for the tasselled end of the strip of material used as a garter in Highland dress.

Flash Bomb. Missile to assist air-to-ground photography, developed during the Second Great War. The R.A.F. used 1,000,000 candle-power cartridges for low altitude photography purposes and 200,000,000 c.p. flash bombs for greater heights. Night photography by the U.S.A.A.F. was carried out at still greater heights with 700,000,000 c.p. flash bombs, a large area being photographed with a single exposure lasting about $\frac{1}{10}$ sec.

Flashlight Photography. Photography by the brilliant light obtained by burning magnesium. It is used chiefly for portraits, groups, and interiors of moderate size. In one apparatus fine magnesium is blown through the flame of a spirit lamp, but the magnesium is usually combined with chlorate or perchlorate of potash, and fires readily on the application of a taper or electric spark. The

chief drawback to these "flash-powders" is the smoke which is produced by them. To overcome this defect, photo-flashes or flash bulbs have been produced consisting of a bulb containing magnesium foil in an atmosphere of oxygen and other gases. An instantaneous flash is produced by the rapid combustion of the magnesium foil, giving an intense white light of 25,000-55,000 lumen-seconds. The flash is initiated by a small filament heated momentarily by an ordinary dry cell. Flash bulbs, which can be used only once, are arranged to screw into a pocket torch.

Flash Point. Temperature at which a substance gives off sufficient vapour to form an inflammable mixture with air. The test is specially applied to petroleum products and is indicative of volatility and fire hazard. The substance under test is contained in a metal cup which is evenly heated at a stated rate. A small test flame is applied at regular intervals to the vapour space in the cup until a bluish flame appears; the temperature of the substance at that instant being recorded as the flash point. Heating may be continued until such time as the vapour burns continuously for at least 5 secs.; the temperature of the substance then is recorded as the fire point. A lower figure will be obtained if the cup is fitted with a cover than if it is open.

Standardisation of apparatus and procedure is essential. In Great Britain the Abel tester is specified for substances with flash points below 120° F. and the Pensky-Martin apparatus for substances flashing above that temperature. A minimum flash point

(Abel, closed cup) of 73° F. is demanded for kerosene by the British Petroleum Act. The minimum for fuel oils is usually 150° F. (Pensky-Martin, closed cup). This minimum is specified so that an inflammable liquid is safe in its normal conditions of storage and use. Recognition of the nature of the liquid is as important in avoiding the danger of explosion and fire as is compliance with statutory standards.

Flash Spectrum. Transient spectrum of the sun's atmosphere, first observed at the total eclipse of 1870. As the moon moves across the narrowing crescent of the sun's disk, the absorption spectrum of the solar surface gives way to a bright-line spectrum which flashes out for a few seconds until the sun's atmosphere, too, is covered by the moon. The reverse phenomenon happens a few minutes later when the moon uncovers first the sun's atmosphere and then the bright disk itself. Study of the flash spectrum enables the physical condition as well as the chemical composition of the sun's outer layers to be deduced.

Flask. (1) In founding, a wooden or iron box or frame-like structure for holding the sand or material forming a mould into which molten metal is poured for making a casting in a foundry. The flask comprises a cope, or top member; a drag, or bottom member; and, when used, intermediate members termed cheeks. If the mould is contained in two or more members, the structure is known as a two-part flask, a three-part flask, etc.

(2) Vessel of glass, metal, etc., usually having a neck, and provided with a body portion which

may assume a variety of shapes, for use in storing and heating liquids, and, formerly, as a receptacle for gunpowder.

(3) In ordnance, a metal reservoir for storing compressed air which forms the actuating medium of a motor for an automobile torpedo.

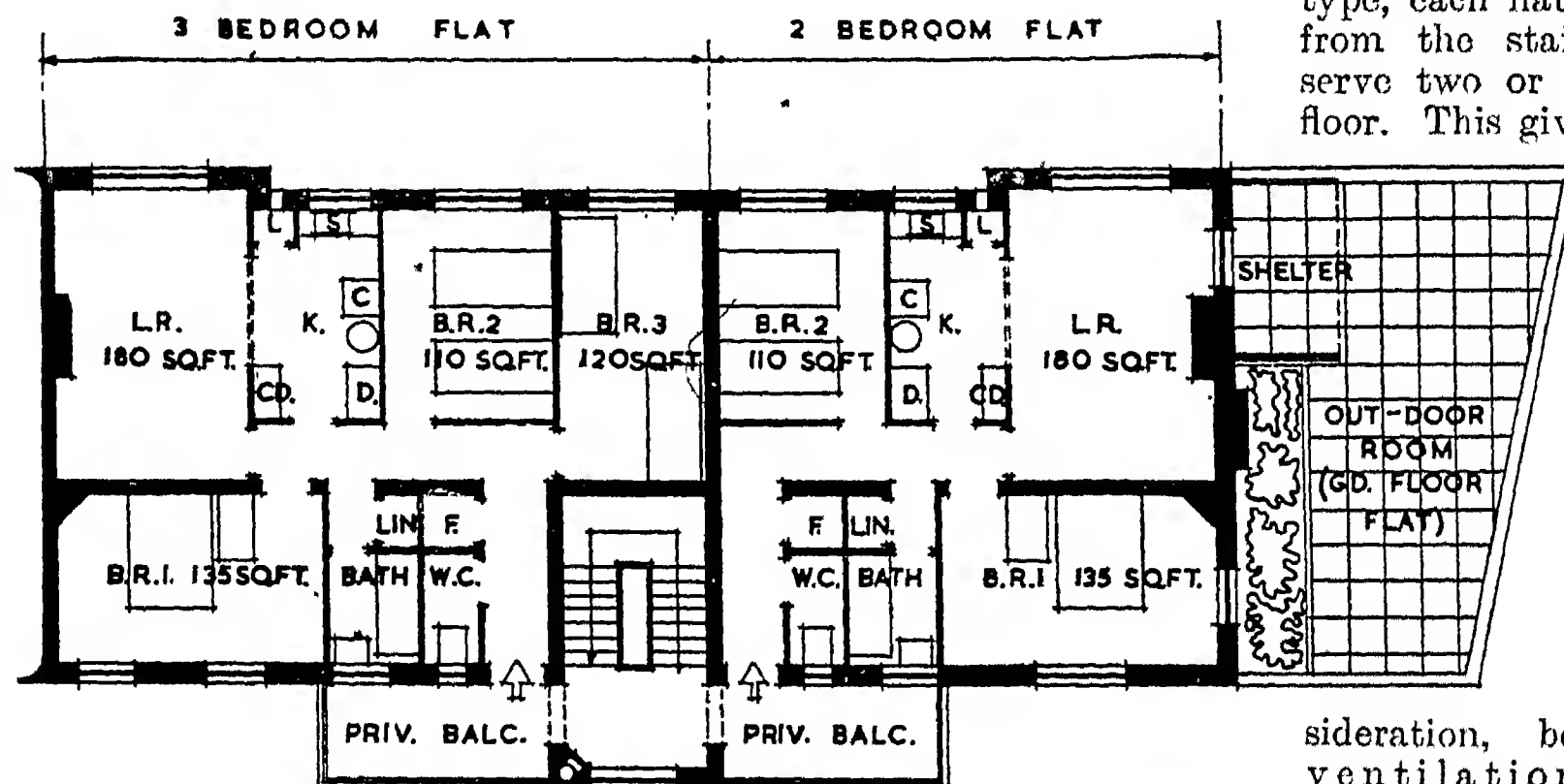
Flat. Separate residence, one of several, each at one level, in a single building. Where the planning arrangements are similar but the accommodation of each dwelling is on more than one floor, the dwellings are called maisonettes. Blocks of flats or maisonettes fall into two main classes: (1) those provided by local authorities, voluntary planning associations, or housing trusts, the rents being artificially reduced by subsidy; (2) commercial flats built and let on a profit-making basis.

Living in flats has now become an accepted feature of British social structure, for ownership of a house with its own garden is often precluded by the need to live near the centre of a large town. In areas populated by, say, 150 persons per acre, housing is normally possible only in flats. The siting of blocks is important. There must be ample space between them to avoid overshadowing, and to provide sufficient sunlight, fresh air, and open space. Blocks running N.-S., with windows facing E. and W., provide the best arrangement. Ideally bedrooms and kitchens should be on the E. and living rooms on the W.

The balcony access type is probably the most economical in cost, particularly where lifts are installed, access to each flat being from a long external balcony at each floor. In the direct access type, each flat is entered directly from the staircase, which may serve two or more flats at each floor. This gives a greater degree

of privacy, better ventilation, and more sunlight. The corridor access type, in which the flats are approached from each side of an internal corridor, is more suited to hotel planning than to flats, built commercially with profits a first con-

sideration, because mechanical ventilation, with increased capital and maintenance costs, is generally necessary for the corridors.



Flat. Architect's lay-out of the first floor plan of a three-storey block of flats, showing the advantages of the balcony access type; each of the adjacent flats is entered through a private balcony from a common staircase

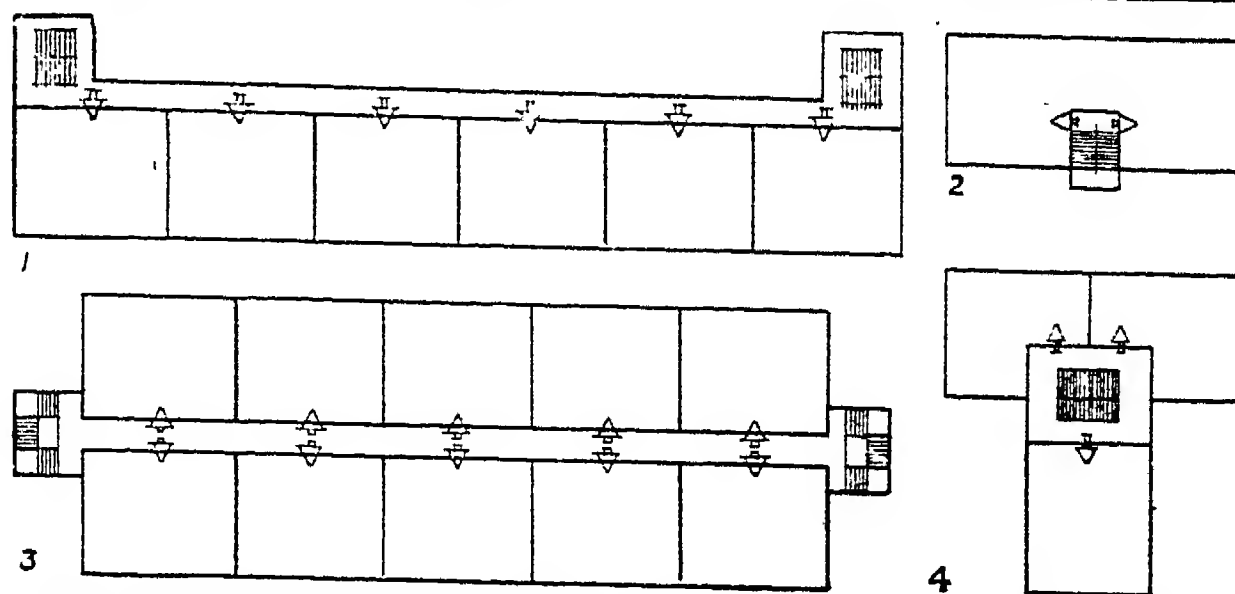
The limit of heights of individual blocks is controlled by legal limitations and by the cost of construction. Hitherto the majority of blocks provided by local authorities have been of five storeys, the lowest three floors being planned as flats and the upper two as maisonettes. Cost increases disproportionately above eight or nine storeys, but buildings six or seven storeys high are likely to be common. Lifts may be provided in blocks of more than three storeys built by local authorities under the terms of the Housing Act, 1946. Sites on main roads often have shops on the ground floor. Gardens, children's playgrounds, and accommodation for communal activities are desirable features of large estates.

Social changes have rendered obsolete many large houses originally intended for single families, but many of sound construction have been converted into flats. Large detached or semi-detached houses are usually comparatively easy to deal with. For terrace houses it is better to convert a number together, uniting the buildings at each floor level by breaking through the party walls. Redundant staircases can then be removed.

Flat. In music, a sign (♭). It indicates that the note to which it refers is to be a semitone lower in pitch than the ordinary note of the same alphabetical name or in the same position on the stave. It was first applied to the note B, and the sign was actually a little *b*, to distinguish this note from *♯* B which in Germany was and is still called H (*♯*=*h*). See Double Flat; Natural; Semitone; Sharp.

Flatbush. District of Brooklyn, U.S.A., one of the boroughs of New York. Formerly a township of King's co., Long Island, it became part of the borough in 1898. It was settled by the Dutch in 1651. On Aug. 23, 1776, Lord Cornwallis's division of Lord Howe's army occupied Flatbush, and the battle of Long Island fought four days later is sometimes called by this name.

Flateyjarbok. Icelandic manuscript dating from the 14th century. Among other things it contains some account of the voyages of the Norsemen of the 10th and 11th centuries to the American continent. Flateyjarbok (the Book of Flatey) is preserved at Copenhagen. Consult Anecdotes of Olave the Black, J. Johnstone, 1780; Flateyjarbok, ed. G. Vigfusson and C. R. Unger, 1860-68.



Flat. Plans showing different means of access: 1, balcony access; 2, direct access, twin type; 3, corridor access; 4, direct access, multiple type

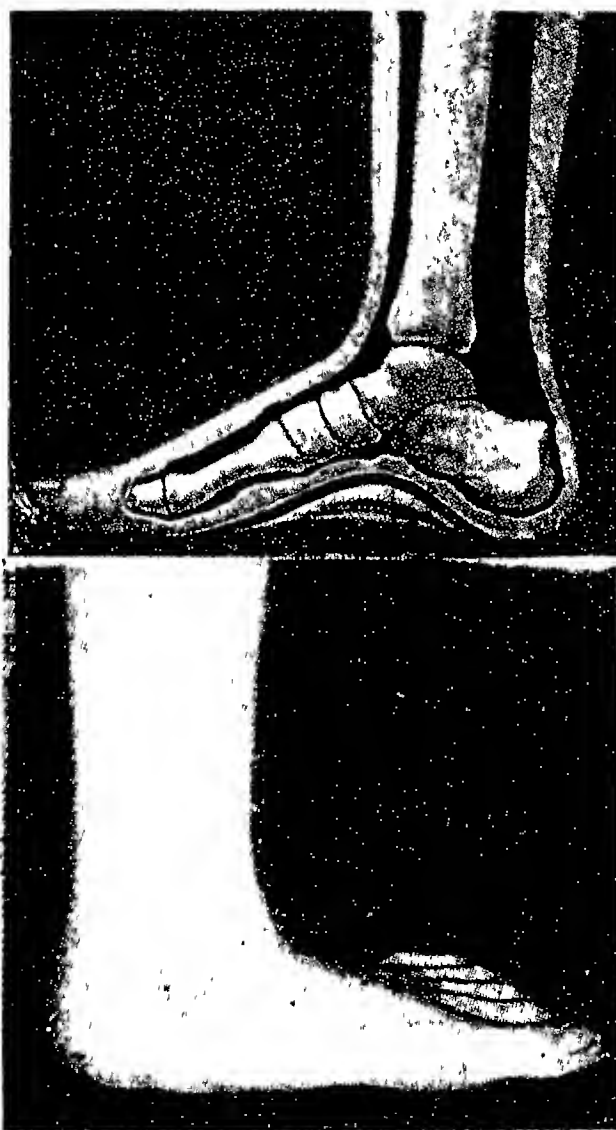
Flatfish (*Pleuronectidae*). Large group of fishes of flattened shape, in which the two sides are unlike in colour and the two eyes are on one side. The plaice and sole are examples. In these fish the body is greatly compressed laterally. In early life the flatfish are symmetrical, and swim like round fishes. Then they become flattened, the body tilts over, and the fish takes to swimming on its side and to lying on the bottom of the sea. The upper side then becomes darkened, and assumes a hue which approximates to the nature of the ocean bed on which it lies, while the markings closely resemble the gravel and mottlings of the sand or mud. At the same time, the eye on the under side gradually works round to the upper surface and the mouth becomes more or less twisted. The eyes stand out from the head and

can be turned independently in different directions. Flatfish are marine in habit, though flounders frequently ascend rivers, and a few species have adapted themselves to a life in fresh water. Most are good table fish.

Flat Foot. In mankind, a condition in which the arch of the foot is reduced, or in bad cases nearly abolished, so that almost the whole extent of the sole comes in contact with the ground. Flat foot is most common in young persons of poor physique, whose occupation has necessitated their standing for long periods, or frequently carrying heavy weights. Occasionally it may result from injuries which have torn or weakened some of the ligaments of the foot.

Flat foot produces feelings of fatigue and weakness after a comparatively small amount of exercise. Irritability and headache result from jarring of the brain pan, the transmission of which jarring through the spinal column is prevented by the spring of the normal arch. Severe pain may be felt in the sole, and the gait becomes shuffling and awkward. Eventually the whole posture of the body may be altered, particularly when the condition is more marked in one foot than in the other. Compensatory changes may result in a tilting of the pelvis, curvature of the spine, and even changes in the position of the shoulders.

In early cases, where weakness rather than actual deformity of the arch is present, rest should be enjoined; at the same time the patient should undergo a course of instruction in exercises specially designed to strengthen the weak parts. Electrical stimulation of the muscles helps. When the condition is more marked it is necessary to afford artificial support to the arch of the foot by instep-pads worn inside the shoes,



Flat Foot. Illustration of a severe case. Upper diagram shows the foot with corrective apparatus supporting the arch

or by raising the inner part of the shoe sole. These measures, however, merely relieve the symptoms, and have no curative power. In chronic cases, remedial measures may prove useless, though a surgical operation may relieve the condition. See Foot.

Flatford. Village of Suffolk, England, on the Stour near the Essex border. Its fame rests on its mill, which formed the subject of a picture by John Constable. The mill-house, restored, was presented to the National Trust in 1928 and in 1946 was leased by the Council for the Promotion of Field Studies.

Flatman, THOMAS (1637-88). English miniaturist. He was born in London, and educated at Winchester and New College, Oxford, of which he was scholar and fellow. He became a barrister and practised poetry and miniature painting as an amateur, the latter with conspicuous success. Walpole cites a portrait of Dr. Tooke's father by him which was highly praised by contemporary connoisseurs. He died Dec. 8, 1688.

Flattery. Cape or promontory of Washington, U.S.A. At the S. side of the entrance to the strait of Juan de Fuca, it is the extreme N.W. point of the state. There is another cape of this name in Queensland, Australia, in Banks co. about lat. 14° 52' S.

Flatulence (late Lat. *flatulentus*, full of wind). Term describing an undue amount of gas in the stomach or intestines. In the normal digestive tract anything over the normal amount of gaseous product is absorbed by the lining mucous membrane; flatulence can be caused by hysteria, a wrong balance of acid and alkali, inadequate secretion of bile, or mechanical blockage causing a reflex hold-up of the intestinal contents. Much flatulence travelling in an upward direction nearly always implies air-swallowing; many hysterical women habitually swallow air. Gas may occur from fermentation in the lower part of the digestive tract when the bile is unable to discharge its anti-bacterial function. The food-stream may be too acid or too alkaline. A duode-

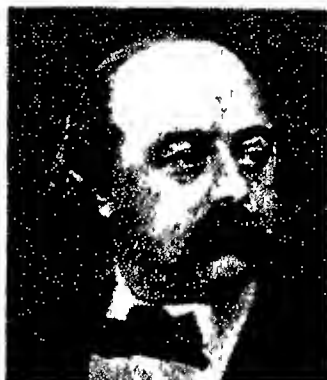
nal ulcer, an inflamed appendix, a haemorrhoid, or any new growth of the intestinal tract may give rise to this condition.

Relief is obtained by removing any mechanical cause and adjusting food intake and the rate and time of intake so as to correct any chemical imbalance. The importance of adequate biting surface for the teeth cannot be overstressed.



Flatford, Suffolk. Mill on the river Stour, subject of a famous painting by Constable, and now the property of the National Trust

Flaubert, GUSTAVE (1821-80). French writer. Born at Rouen, Dec. 12, 1821, the son of a surgeon, he went to Paris to study law in 1840, and spent a number of years in travel, visiting the East in 1849-50. Returning to France in 1850, he settled at Croisset, near Rouen, and began to write. His first work, in dramatic form, *La Tentation de S. Antoine* (Eng. trans. R. Francis) was not pub. until 1874. *Madame Bovary*, the novel that was to make him famous, and is undoubtedly his masterpiece, took six years



G. Flaubert

of constant labour; it was published serially in 1857. An action against author and publisher for its alleged immorality was dismissed. There followed an epic story of Carthage, *Salammbô* (Eng. trans. M. F. Sheldon), 1862; *L'Éducation Sentimentale*, a survey of contemporary life, 1869; *Trois Contes*, 1877; and the posthumous *Bouvard et Pécuchet*, 1881. Flaubert died May 8, 1880, having long been broken in health.

He was the dominant figure among French novelists of the last epoch of Romanticism. A literary

descendant of Balzac, he was by turns a sheer realist and a sheer romanticist, in both aspects brilliant and infinitely laborious. He took his art very seriously, tormenting himself for days in the search for a word, polishing his work with untiring zeal. His technical skill, especially as a realist, greatly influenced later French writers, in particular the de Goncourts and Zola. An edition of his works in 18 vols. was completed in 1910. Consult Lives J. Wassermann, 1906; L. Bertrand, 1912; P. Spencer, 1952; Letters, Eng. trans. F. Steigmüller, 1954.

Flaveria contrayerba. Biennial herb of the family Compositae. A native of Peru, it has opposite, saw-toothed, lance-shaped leaves, and yellow flower-heads. In Chile a yellow dye is obtained from them.

Flavine (Lat. *flavus*, yellow). Complex organic substance used as an antiseptic. Its value was discovered in 1916 by the Bland-Sutton institute for clinical pathology at the Middlesex Hospital, London. The discovery of the drug itself was due to Prof. Ehrlich, who treated cases of sleeping sickness with it. Flavine is a yellow dye belonging to the acridine series, hence its official name acriflavine. It is harmless to the tissues, though it may sometimes form scars. The discovery of its efficacy as an antiseptic was hastened by the need for such a drug occasioned by the First Great War. See Antiseptics.

Flax (*Linum usitatissimum*). Annual plant of the family Linaceae. Its native country has not been decided with certainty; there appear to be at least two centres of origin, S.W. Asia, to which a small flower and small seed form are peculiar, and the countries on the S. shores of the Mediterranean, where a large flower and large seed form predominate. The form known in the British Isles

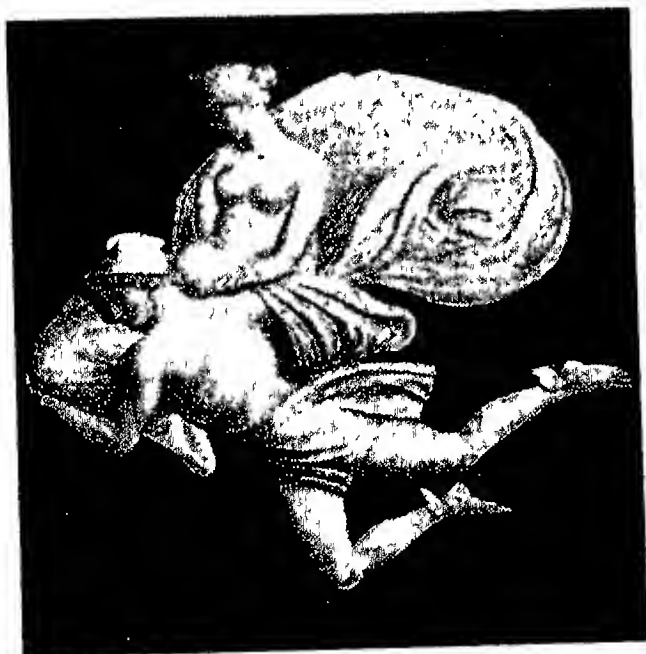


Flax. Stem, leaves, and flowers of *Linum usitatissimum*

and other countries where flax is grown for its fibre is a fine unbranched erect plant, 3-3½ ft. high, with small alternate lanceolate leaves and usually blue flowers; the fruit is a spherical capsule with five compartments each containing two brown, lens-shaped seeds. Although the flowers are usually blue, with blue or yellow pollen grains, there are fibre varieties with white flowers and either blue or yellow pollen grains.

When intended for high quality fibre, the plant is pulled by up by hand or by mechanical means, and tied in small bundles preparatory to "retting." The crop is pulled before the seed is ripe; consequently the crop cannot have a dual purpose, the producer deciding upon either seed or fibre. Retting, or literally rotting, consists of submerging the sheaves of flax in ponds or slowly flowing streams for 8-12 days, during which a process of fermentation is set up that separates the outside and inside layers of tissues of the stem from the phloem or fibrous portion. After retting the sheaves are opened and the flax is spread out to dry; after drying, it is subjected to scutching, a mechanical means of separating fibre from other portions of the stem. After the removal of all adhering portions of the stem, fibre is transferred to the spinner and then to the weaver, by whom it is converted into the desired textile.

Linen has been used by man since the dawn of history. In



Flaxman. Mercury and Pandora, an example of John Flaxman's work

England in Tudor times, and later, the cultivation of flax was made compulsory. Although flax is still grown to a limited extent in England, British cultivation on a substantial scale is now confined to N. Ireland. During the Second Great War the main sources of supply, notably Belgium, were

cut off, and efforts were again made in England to grow flax for fibre. The yield of scutched flax per acre varies seasonally; the highest recorded in N. Ireland was 48 stones in 1847, and the lowest 12.7 stones in 1871; on an average it is between 25 and 30 stones. Linseed, i.e. seed of the flax plant, is produced for commercial purposes in India and Argentina. Seed rather than fibre being the objective, plants with short straw and strongly developed branching habit and large seed are cultivated. Approximately one-third of the weight of linseed is oil, and the residue of the seed after oil has been abstracted forms a valuable livestock concentrate. All forms of flax require well tilled land, free of weeds, and an ample supply of potash; the fibre crop also succeeds best in localities with ample rainfall and a general high humidity.

Flaxman, JOHN (1755-1826). English sculptor. Born at York, July 6, 1755, he was the son of a maker of plaster casts. Owing to physical deformity, his childhood in London was passed mainly in his father's shop, where he drew, modelled, and studied the classics. In 1770 he entered the Academy schools, having previously exhibited and gained awards at the Society of Arts, the Free Society of Artists, etc.; and in 1775 began to be regularly employed by the Wedgwoods in designing classical friezes and medallions for their ware. Married in 1782, Flaxman and his wife went to Rome in 1787. Returning in 1794, they settled in London. In 1797 he was elected A.R.A., and R.A. in 1800, and in 1810 was appointed professor of sculpture. He died Dec. 7, 1826.

Flaxman's most notable monumental works are in Westminster Abbey and S. Paul's, his classical figures and groups at Petworth, Woburn, and other country seats, and his characteristic memorial reliefs are numerous in the British

cathedrals and churches. Collections of his drawings are in the British and South Kensington museums, and the Fitzwilliam museum, Cambridge. University college, in Gower Street, London, housed in the Flaxman gallery original drawings and sketches in pen and pencil, and also plaster casts from his clay models. This collection was badly damaged in 1940 during German bombing raids from the air.

Flea (order Aphaniptera or Siphonaptera). Group of about 1,000



Flea. Much enlarged specimens. 1. Rat flea. 2. Common flea, *Pulex irritans*, male and, 3, female

1 Photographed at Nat. Hist. Museum, S. Kensington

species of small wingless insects, living when adult as parasites on birds or mammals. The body is laterally compressed, with a tough, shiny integument. The hind legs are very large and used for leaping. The vertical leap of the common flea is stated to be 7½ ins. Usually each species lives on a particular host, but many can live, at least temporarily, on a different host. The mouth-parts are piercing organs used for sucking blood—the staple food of fleas. The rat flea migrates readily to man, and is a carrier of the bacillus of bubonic plague. Eggs of fleas are normally laid in the haunts or sleeping places of the hosts. The larvae are worm-like and feed on debris, those of the common flea taking in organic particles among the dirt of floors.

Fleabane (*Pulicaria* and *Eriogeron*). Group of herbs of the family Compositae. *P. dysenterica*, a native of Europe, N. Africa, and



Fleabane. Leaves and flowers of *Pulicaria dysenterica*

the Himalayas, is a perennial, with creeping rootstock, erect stems, and heart-shaped, oblong, woolly leaves. The daisy-like flower-heads are bright yellow. It was formerly used as a medicine in dysentery. Canadian fleabane (*Erigeron canadensis*), generally distributed in warm and temperate regions, is an annual, with stem 1 or 2 ft. high and narrow, lance-shaped leaves. The small, yellow-centred, white flower-heads are clustered.

Flèche, LA. Town of France. It stands on the Loir, 24 m. S.W. of Le Mans, in the dept. of Sarthe. It is an agricultural centre, trading in corn, wine, etc., and has also some small manufactures; its buildings include a town hall, museum, and theatre. More famous is the military school here known as the Prytanée, from which students pass to St. Cyr. Founded in 1774, this occupies the buildings of a Jesuit College, and has a large library. The earlier college, at which Descartes was educated, was founded in 1604 by Henry IV, to whom there is a statue in the market place. La Flèche was liberated in the rapid U.S. advance at the beginning of Aug., 1944. Pop. (1954) 11,275.

Flecker, JAMES ELROY (1884-1915). British poet. Son of a clergyman and born in London, Nov. 5, 1884, he was christened Herman, which name he changed to James later. He was educated at Dean Close, Cheltenham, Uppingham, and Trinity college, Oxford. He joined the consular service in 1910, the year in which his *Twenty-Six Poems* appeared, and served in Constantinople (Istanbul) and Smyrna (Izmi.); but tuberculosis forced him to abandon his profession, and he died at Davos, Jan. 3, 1915.

Flecker early showed signs of becoming one of the most notable poets of his generation, and lived to see his work recognized by the critics. He possessed a fine, lyric quality, and took a sensuous delight in words of colour. Such poems as *The Old Ships*, *The Dying Patriot*, and *To a Poet a Thousand Years Hence*, found a permanent place in anthologies; others include *The Golden Journey to Samarkand*, and *Oak and Olive*. The oriental drama *Hassan* (q.v.) is considered his masterpiece. Flecker's poems were collected by J. C. Squire in 1916 (new ed. 1946), and biographical volumes were published by D. Goldring, 1922, and G. Hodgson, 1925. Consult *Some Letters from Abroad* of J. E. F., 1930.

Fleece. Coat of the live sheep removed by shearing and forming a fairly coherent mass by the interlocking of adjacent fibres. Fleeces deprived of some of their inferior portions are rolled into bundles, secured by a twist of their own fibre, and packed into bales or into bags known by the trade name of sheets. Locks and pieces are portions of the coat separated by accident or design from the main bulk or fleece. In the course of wool-sorting the fleece is opened out and examined. Fleeces of like quality placed together are described as cased.

Wool of different strengths grows upon different parts of the body, and in sorting wool fully the fleeces are broken up. When the respective sorts of wool from many fleeces have been collected together the lots are given the name of matchings. The term fleece wool in some parts of the country implies wool not of the first clip. Certain manufactured goods, e.g. warm linings, are called fleece from their warmth and fleecy appearance. See Wool.

Fleet (A.S. *flēotan*, to float; cf. Ger. *fließen*). Naval term signifying a number of ships under the supreme command of a single officer. In the Royal Navy a battle fleet consists of five or more capital ships with attendant cruisers and destroyers and supply vessels. At one time fleet was synonymous with squadron, but nowadays the fleet is a much larger unit. A group of vessels operating in a specified area is generally given the title of fleet; thus in the Second Great War there was the Pacific Fleet. In peace-time the Royal Navy is divided into the Home, Atlantic, and Mediterranean fleets. In the U.S. navy the word has largely been replaced by the term task force. The whole navy of a nation is often called the fleet, e.g. the British fleet. See Fishing Fleet; Grand Fleet; Navy; Squadron.

Fleet. Urban district of Hampshire, England. It is 6 m. N.E. of Odiham and 36 m. S.W. of London, with a rly. station. A feature is Fleet Pond, a sheet of water 130 acres in extent. Pop. (1951) 9,015. There is also a village of this name in the parts of Holland, Lincolnshire, 2 m. S.E. of Holbeach.

Fleet, THE. Name of the navigable part of an old London river which, rising in Hampstead, entered the city S. of Chick Lane (now Charterhouse Street) and joined the Thames at Blackfriars. First mentioned in a 12th century MS., it was known as the Fleet Ditch, owing to the frequency with

which it became choked with refuse. The N. part was known as the Holebourne, whence Holborn. After the Great Fire of 1666 it was cleansed, deepened, and called the New Canal. Wharves were erected as well as bridges at Holborn, Fleet Lane, Fleet Street, and Bridewell. The part between Holborn and Fleet Street was arched over in 1737, and later the stream was converted into a sewer, its course being covered by Farringdon Street (q.v.) and New Bridge Street.

Fleet Air Arm. Name of the Royal Air Force component attached to the Royal Navy, 1922-1937. It continued in common use after the formation of the Air branch of the R.N. in 1937.

Flying from ships began in 1911 (see Aircraft Carrier). With the amalgamation of the R.N.A.S. and the R.F.C. to form the R.A.F. on April 1, 1918, all aviation came under the Air ministry. This first introduced non-naval personnel into the air component of the R.N. When the R.A.F. was reorganized for peace-time duty in Dec., 1919, R.A.F. units attached to the fleet for naval air duty were administered by a new R.A.F. command called Coastal Area.

The F.A.A. was created in 1922 to give the R.N. a measure of participation in the R.A.F. naval air component. Thereafter, air units allotted to the F.A.A. included a proportion of naval officer pilots, eventually reaching the maximum proportion of 70 p.c. naval to 30 p.c. R.A.F. personnel. Navigator and observer duties were carried out by specially trained naval officers. Naval ratings were trained as wireless-operator/air-gunners. The officer in command of flying and the aircraft engineer officer in each ship were for many years R.A.F. officers. R.A.F. airmen serviced the aircraft and engines and airframes on board ship and ashore; naval ratings provided the aircraft handling parties. Naval pilots (but not the observers) were seconded to the R.A.F. while attached to the F.A.A. and held commissions at equivalent rank in the R.N. and the R.A.F.; but R.A.F. pilots were not seconded to the R.N.

The Admiralty had full operational control over all R.A.F. units allotted to the F.A.A., and full disciplinary control when units were embarked. The Air ministry had administrative and disciplinary control when units were disembarked to shore air stations (which were then ex-

clusively R.A.F.), retained the functions of design and supply of aircraft and equipment (in consultation with the Admiralty), and undertook initial flying training. The first naval officer pilots' course began in 1924. Pilots were normally seconded to the F.A.A. for four years, after which they returned to purely naval duty.

The F.A.A. was organized in squadrons and flights, with squadrons normally posted to aircraft carriers, and flights to fleets or naval squadrons for duty in fighting ships fitted with catapults (battleships, battle cruisers, and cruisers carrying from one to four aircraft). Fighting ship aircraft were usually either seaplanes or amphibians, able to alight in the water alongside to be hoisted inboard after flight. Except for experimental aircraft, carrier-borne aircraft were landplanes fitted with deck arrestor gear.

By March 31, 1931, the strength of the F.A.A. was equal to 13 squadrons (about 156 operational aircraft) to meet the requirements of six aircraft carriers and various fighting ships. In May, 1935, the first-line strength was 175 aircraft. In 1937 the R.A.F. Far East command administered five and the R.A.F. Mediterranean command eight F.A.A. squadrons; total first line strength was 222 aircraft.

Control Transferred to Admiralty

On July 30, 1937, Neville Chamberlain (British prime minister) announced that complete control of the F.A.A. was to pass to the Admiralty, and the official title of the F.A.A. was changed to Air branch, R.N.; personnel became entirely naval; but opportunity to transfer to the Air branch was offered to R.A.F. personnel serving with the F.A.A. The Air ministry transferred four R.A.F. shore air bases to the Admiralty for the exclusive training of naval air personnel. In accordance with naval custom these stations were described as H.M. ships and given "ship" names in addition to their geographical names. The Admiralty at once began to train its own technical officers, previously lacking in the navy; but for a time the R.A.F. continued to provide preliminary flying training.

In April, 1938, to build up a trained reserve, the Admiralty opened a short service Air branch for commissioned officers, and on May 24, 1939, duality ended.

SECOND GREAT WAR. At the outbreak of war the Royal Navy had in commission eight aircraft carriers. The majority of these

were soon performing front-line service with the fleet in various theatres of war; H.M.S. Courageous was sunk by a U-boat in the first month. Flying equipment was scanty, and (by comparison with that of the R.A.F.) of inferior performance. Moreover, the value of naval aircraft was at first underrated in many influential quarters.

The F.A.A. was first in the public eye when a single Seafox seaplane spotted for the naval guns at the battle of the River Plate, Dec., 1939; but with the growth of naval power and the increasing tempo of the war its work grew steadily more important to the strategists and more spectacular to the outside observer. The worth of the Fairey Swordfish (*q.v.*) torpedo bomber was demonstrated at Narvik in April, 1940. In June the Glorious was sunk, but the first of a new generation of fleet carriers, the Illustrious and the Formidable, were ready. Swordfish from the Illustrious achieved the historic attack on the Italian fleet at Taranto (*q.v.*), Nov. 11, 1940, while Albacores and Swordfish flown from the Formidable contributed to the British naval victory of Matapan (*q.v.*), Mar. 28, 1941.

Another action in which the F.A.A. cooperated notably with other forces was the sinking of the German battleship Bismarck (*q.v.*) in April. This was one of the outstanding events in the career of H.M.S. Ark Royal (*q.v.*), last carrier launched before the war. A glorious failure was the attempt by a squadron of Swordfish, led by Lt. Cdr. E. Esmonde (awarded a posthumous V.C.) to destroy the Gneisenau (*q.v.*) and the Scharnhorst, Feb., 1942. The crippling attack on the Tirpitz by the then new Fairey Barracuda dive-bombers (April 3, 1944) was more successful.

The escorting of convoys to Malta and Russia, and the introduction on a large scale of merchant aircraft carriers and "pocket" escort carriers (largely U.S.-built) called into being the two-seat Fairey Fulmar, and the single-seat Sea Hurricane, and soon afterwards the Seafire, little slower than the Spitfire.

It was found that carrier-borne aircraft, despite the apparent vulnerability of their "base," were essential

to any large-scale "task force," and design and production of naval aircraft were given a proper priority. The most successful U.S. designs—Grumman Wildcat, Hellcat, the torpedo-carrying Avenger, the Vought Corsair—also appeared in large numbers under the flag of the Royal Navy, and a further Fairey naval aircraft (the Firefly two-seat fighter) reached squadron service.

Personnel, ships, and aircraft of the Fleet Air Arm played a supporting but vital role in the invasion of France, from north and south, in 1944, and continued to operate extensively from shore bases, particularly in minelaying.

The British Pacific Fleet, formed late in 1944 for the final assault on Japan, included several fleet carriers, notably the Illustrious, and four of the new light fleet carrier class. The Indefatigable, the Victorious, and the Formidable were all hit by Japanese suicide bombers, but survived the last savage battles, and earned high praise from the U.S. commander-in-chief. The British carrier force destroyed 148 enemy aircraft and sank 108 ships in the 42 days preceding the surrender of Japan.

The total personnel of the R.N. Air branch then numbered over 70,000, and the strength in first-line aircraft had increased from 340 to about 1,500. In 1946 the Fleet Air Arm was integrated into the Navy, and ceased to have a separate identity. See Royal Naval Air Service; Royal Navy. Consult Fleet Air Arm (H.M.S.O.), 1943; The Fleet Air Arm, J. Moore, 1943.

Fleet Prison, THE. Former prison of old London. Its history has been traced back to the 12th century. Named after the Fleet river, it stood on the E. bank of that stream, S. of Fleet Lane, was burnt in the Great Fire, rebuilt, destroyed in the Gordon riots of 1780, rebuilt again in 1781–82,



Fleet Prison. The inner court, with prisoners engaged in a game of racquets

From a drawing by Rowlandson & Pugin, 1807

purchased by the City Corporation in 1844, used as a stone-yard, and sold in 1864 to the L.C. & D.R. On part of the site was erected the Memorial Hall. The prison was used for prisoners of the Star Chamber, and later for debtors and bankrupts. The register books are preserved at Somerset House.

The poet Surrey, Bishop Hooper, Thomas Nash, Donne, Falkland, Prynne, James Howell, Wycherley, and Richard Savage were among notable prisoners here; as, among literary creations, were Falstaff, Mr. Pickwick, and Shandon, the shiftless journalist of Thackeray's *Pendennis*. Here, and in the liberties, clergymen imprisoned for debt celebrated clandestine marriages, between 1614 and 1754, when they became illegal. Favoured

29, 1940) and S. Dunstan-in-the-West, the remains of Clifford's Inn and the second Serjeant's Inn, part of the Law Courts, entrances to the Temple (*q.v.*), and, near to the last-named, a restored timber house of 1610, the projecting upper storey of which, called Prince Henry's Room, is described as the council chamber of the duchy of Cornwall in the time of James I.

Chiefly on the N. side of Fleet Street are lanes, courts, and squares, *e.g.* Chancery Lane, Fetter Lane, Shoe Lane; Bolt Court, Crane Court, Wine Office Court, Johnson's Court, Red Lion Court; Gough Square. To the S. are Old Mitre Court and Salisbury Square. Whitefriars Street reminds the passer-by of the Carmelite monastery which once stood near. The Cheshire Cheese, Cock, Peele's, and Rainbow represent taverns and coffee houses of an earlier day. The site of the old Mitre tavern of Johnson's time is covered by Hoare's Bank, and that of the Devil tavern by Glyn Mills (Child's) Bank.

Known as the street of ink, from its associations with newspaper offices, the street contains the superb modern offices of the Daily Telegraph, the unusual steel and glass building of the Daily Express, the fine modern block housing Reuter's,

and the London offices of most of the provincial, Empire, and foreign journals. The Great Fire of 1666 extended to Clifford's Inn on the N. side and to the Temple on the S. side, and after it the street was virtually rebuilt.

Wynkyn de Worde, the printer, worked at No. 32, near Temple Bar; Richard Tothill had his printing office in Fleet Street, and here Gorboduc, the first English tragedy, was printed and published. Punch offices, formerly at the N.W. corner of St. Bride's Avenue, were moved to Bouverie Street. At No. 32 John Murray the first published Byron's *Childe Harold*, and John Murray the second the early numbers of the *Quarterly Review*. Samuel Richardson had a house

in Salisbury Court. Michael Drayton and Cowley lived in Fleet Street; Samuel Johnson in Bolt Court, Johnson's Court, and Gough Square. Defoe stood in the pillory within Temple Bar in 1703. Izaak Walton lived on the N. side. The legend of Sweeney Todd, the demon barber, originated in a tale published in 1840. London's first pillar-box was put up at Ludgate Circus in 1855. Outside St. Dunstan's is a bust of Lord Northcliffe, and Edgar Wallace is commemorated by a plaque in Ludgate Circus where he once sold newspapers, while a bust of T. P. O'Connor is on the façade of Chronicle House.

Bibliography. *Annals of Fleet Street*, E. B. Chancellor, 1912; *Fleet Street in Seven Centuries*, W. G. Bell, 1912; *A Londoner's London*, W. Whitten, 1913; *Street of Ink*, H. Simonis, 1917.

Fleet Train. British naval supply and maintenance organization formed early in 1945 to supply and repair units of the British Pacific fleet in operations against the Japanese. The fleet train enabled warships to put in the maximum amount of service at sea without having to return to shore bases for refuelling and repairs, and was, in effect, a floating industrial seaport. Consisting of over 100 ships of 30 specialised types, it could feed, water, fuel, and munition ships of all categories at sea, carry out action repairs to all types from destroyers to battle-ships, and transport drafts up to 1,000 men a month.

Fleetwood. Mun. borough, seaport, and holiday resort of Lancashire, England. It stands at the mouth of the Wyre, on Morecambe Bay, 9 m. N. of Blackpool. It owes its name to Sir Peter Fleetwood, who built quays and rlys., and planned the town in 1836.

It has regular steamer service with the Isle of Man, and carries on a brisk coasting trade. It is the third largest fishing port of the British Isles. Market days, Tues. and Fri., plus Mon. in summer.

In planning Fleetwood as a holiday resort, every advantage has been taken of the marine views. On the golf course every hole is in sight of the sea, and there are bowling and putting greens on the four-mile promenade. There are a sandy beach, swimming pool, boating lake, and model yacht pond.



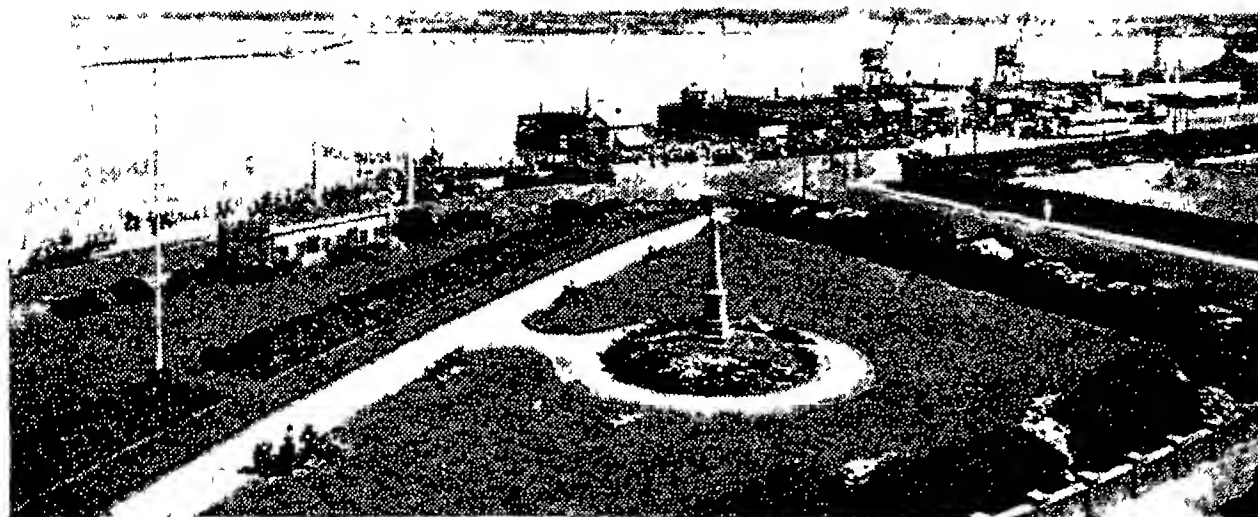
Fleet Street. View looking east to S. Paul's. The spire of S. Bride's, which survived German incendiaries, is seen on the right; the projecting clock, left, belongs to the Daily Telegraph building

debtors were allowed to live in what was known as the rules or liberty of the Fleet, which included the N. side of Ludgate Hill and the Old Bailey to Fleet Lane and Market, and along the E. bank of the Fleet to what is now Ludgate Circus. Consult *The Fleet: River, Prison, and Marriages*, J. Ashton, 1888; *The Chaplain of the Fleet*, W. Besant and J. Rice, 1881.

Fleet Street. London thoroughfare in Farringdon Ward Without. Running W. from Ludgate Circus to Temple Bar, its precincts are closely associated with the ecclesiastical, legal, insurance, banking, publishing, and printing activities of the metropolis. It contains two churches of note, S. Bride's (burnt out in the German fire raid of Dec.



Fleetwood arms



Fleetwood, Lancs. Quays and the promenade, which is four miles long and is bordered by bowling and putting greens and other watering-place amenities

The corporation has provided a marine hall, with ballroom, theatre, and restaurant. Pop. (1951) 27,525. Rossall School lies 3 m. S.

Fleetwood, CHARLES (d. 1692). English soldier. A younger son of Sir Miles Fleetwood, of Northamptonshire, he was trained for the law. He joined the parliamentary army at the outbreak of the Civil War and afterwards commanded



Charles Fleetwood,
English soldier
After Walker

a regiment. In 1646 he entered the house of commons as M.P. for Marlborough. He went with Cromwell into Scotland in command of the horse, and was present at Dunbar and Worcester, being at the time of the latter battle in command of the troops in England. Fleetwood was next commander-in-chief in Ireland, 1652-55, being also lord deputy until replaced by Henry Cromwell. Fleetwood was one of Cromwell's ten major-generals, and sat in his house of lords. He was commander-in-chief when Monk entered London, but he hesitated, and was lost; he did not go over to Charles II, while parliament took from him his command. Though he had taken no part in the trial of Charles I, he was exempted from a complete pardon at the Restoration. He died Oct. 4, 1692. In religion a Baptist, Fleetwood was a zealot, without any of the graces of some of the Puritans. He married in 1652 Cromwell's daughter Bridget, but their relations with the Protector were not uniformly cordial.

Fleg, EDMOND (b. 1874). French author. Born at Geneva of Jewish parents, he served with distinction in the First Great War. His poem *Le Mur des Pleurs*, 1919, was

translated by Humbert Wolfe as *The Wailing Wall*. It was followed in 1922 by *Écoute Israël*, which presents the history of the Jewish race in epic style, using free rhythms. Other poems include *Le Psaume de la Terre Promise*; *Eternel est Notre Dieu*; *Apocalypse*. Fleg was also an outstanding playwright, wrote a successful novel, *L'Enfant Prophète*, and lives of Moses, Solomon, and Jesus (the last as told by the Wandering Jew). His personal manifesto, *Pourquoi Je Suis Juif* (trans. V. Gollancz, *Why I am a Jew*), was, like all his work, inspired by pride of race.

Flegel, EDUARD ROBERT (1855-86). German traveller. Born at Vilna, Oct. 1, 1855, he was appointed to a commercial post at Lagos in 1875, and in 1879 surveyed the Benue river. In 1880 he ascended the Niger to Gomba and in 1882 discovered the source of the Benue. Returning to Europe, he made another expedition, backed by Bismarck, to secure the Benue-Niger district for German trade, but was forestalled by the British Niger Co. He died on the coast at Brass, Sept. 11, 1886.

Fleischer, DAVE (b. 1894). American film cartoonist and director. Born in New York, July 14, 1894, he was educated at the Cooper Union, and in 1920 created and directed a series of animated cartoons for the Bray studios. His initial cartoon series, *Out of the Inkwell*, depicting the adventures of Koko the clown, was among the earliest of its kind in the silent film. His later creations included *Betty Boop*, the doll, and *Popeye the sailor*. His full-length films in colour, *Gulliver's Travels* and *Mr. Bug* (or *Hoppity*) *Goes to Town*, though indebted to the work of Disney (*q.v.*), were notable contributions to the art of film cartoon. Fleischer became head cartoonist to Columbia Pictures in 1942.

Fleming, SIR ALEXANDER (1881-1955). British pathologist. Born at Lochfield, near Darvel, Ayrshire, Aug. 6, 1881, he was educated at Kilmarnock academy and S. Mary's Hospital. After serving with the R.A.M.C. in the First Great War he became professor of bacteriology at S. Mary's, discovering lysozyme in 1922. Fleming realized the possibilities of penicillin (*q.v.*) in 1929, and his research made possible its widespread use in medicine and surgery. He became F.R.S. in 1943, received a knighthood in 1944, shared the Nobel prize for medicine in 1945. He died in London, March 11, 1955.



Sir Alexander
Fleming,
British pathologist

Fleming, DAVID HAY (1849-1931). Scottish historian. Born at St. Andrews, May 9, 1849, he was educated at the university there, and published a guide to the city in 1881. He devoted himself to Scottish history from 1888, and among his publications were *Scotland after the Union of the Crowns*, 1890; *Scottish History and Life*, 1902; *Scottish Reformation*, 1903. He died in Nov., 1931, and his work was the subject of a study by H. M. Paton, 1934.

Fleming, SIR JOHN AMBROSE (1849-1945). British physicist and engineer. He was born at Lancaster, Nov. 29, 1849, and educated in London at University College and the Royal College of Chemistry. He was a science master at Cheltenham in 1874, and worked at Cambridge under Clerk Maxwell, 1877-81. Then he went to University College, Nottingham, as professor of physics and mathematics, returning to London in 1885 as professor of electrical engineering at University College, remaining until 1926. He also acted as adviser to the Edison Electric Lighting Co.



Sir Ambrose Fleming,
British physicist
and engineer

Fleming was associated with the introduction into Great Britain of the telephone, electric lighting by incandescent lamps, and wireless telegraphy. He invented the thermionic valve that revolutionised the practice of wireless, and other

branches of electrical engineering are indebted to him for improvements in method and apparatus. He was elected F.R.S. in 1892 and received a knighthood in 1929. Among his books are *Fifty Years of Electricity*, 1921; *Electrons*, *Electric Waves*, and *Wireless Telephony*, 1923; *Memories of a Scientific Life*, 1934. He died at Sidmouth, April 18, 1945.

Fleming, MARJORY (1803–11). British infant prodigy. Born Jan. 15, 1803, a niece of Mrs. Keith



Marjory Fleming
After a water-colour
by J. Keith

of Ravelston, at whose house Scott frequently saw her, she read history at the age of six and wrote diaries and poems. She died Dec. 19, 1811. Her journals, letters, and verses were collected in 1934; and a biography by O. Malet appeared in 1946. John Brown includes an essay on her in *Horae Subsecivae*.

Fleming (ROBERT) PETER (b. 1907). British journalist. Born May 31, 1907, he was educated at Eton and Christ Church, Oxford, and joined the Grenadier Guards. Some racy and unconventional travel books, e.g. *Brazilian Adventure*, 1933; *News from Tartary*, 1936, brought him a public, and he became an assistant editor and leader-writer on *The Times*. He was later a war correspondent in Norway, 1940, and Greece, 1941. He married the actress Celia Johnson in 1935.

Fleming, SIR SANDFORD (1827–1915). Canadian engineer. Born at Kirkcaldy, Fife, Jan. 7, 1827, he went to Canada and became connected with rly. construction about 1846. After 1871 he surveyed and constructed the Inter-colonial line, and afterwards he surveyed a route through the Rockies for the C.P.R. He advocated an imperial cable system and standard time. Made a K.C.M.G. in 1897, he died July 22, 1915.

Flemings. Name given to the inhabitants of Flanders. A small sect of early Protestants, influenced by the Mennonites, were called Flemings or Flandrians about the middle of the 16th century. Flemings, now predominantly R.C., occupy the west part of Belgium, forming rather more than half the population of that country. In the First Great War most cooperated loyally against the Germans, but behind the German front a group of Flemish

nationalists supported the occupying power. Pardoned by the Belgian government after the armistice, they continued to demand autonomy and achieved a number of concessions. Radical Flemish nationalists envisaged the union of Flanders with the Netherlands. (Flemish is Dutch with a variant accent; written it is the same.) Germany claimed the Flemings as members of the Germanic family, and with the rise of Hitler, Nazi propaganda was considerable in the region. Flemish influence was responsible for Belgium's detachment from France and return to the policy of neutrality before the Second Great War. The "fifth column" in Belgium in 1940 consisted chiefly of Flemings; and after the war the majority of Flemings were strong supporters of Leopold III (*q.v.*), first king of the Belgians to speak Flemish. Chroniclers say that Tostig had Flemish auxiliaries under his flag at Stamford Bridge, 1066. Henry I settled a number of Flemings in Dyfed, S. Wales, about 1108; they were long the objects of Welsh hostility. In the battle with the S. Wales marchers at Teifi Ford, near Cardigan, in 1136, numbers of these settlers were slain. Other attacks on them in 1144 and 1164 were avenged by their harrying of Iscold or Lower Gwent in 1165. Strongly attacked by the Welsh

leader Maelgwyn Gwynedd, 1188, they made submission to Llewellyn I in 1217. Flemings influenced the growth of the woollen and weaving industries in England, especially in E. Anglia. See *Flanders*.

Flemington. Suburb of Melbourne, Victoria. It is 3 m. N. of the city and has a fine racecourse, founded 1861, on which is run the race for the Melbourne Cup.

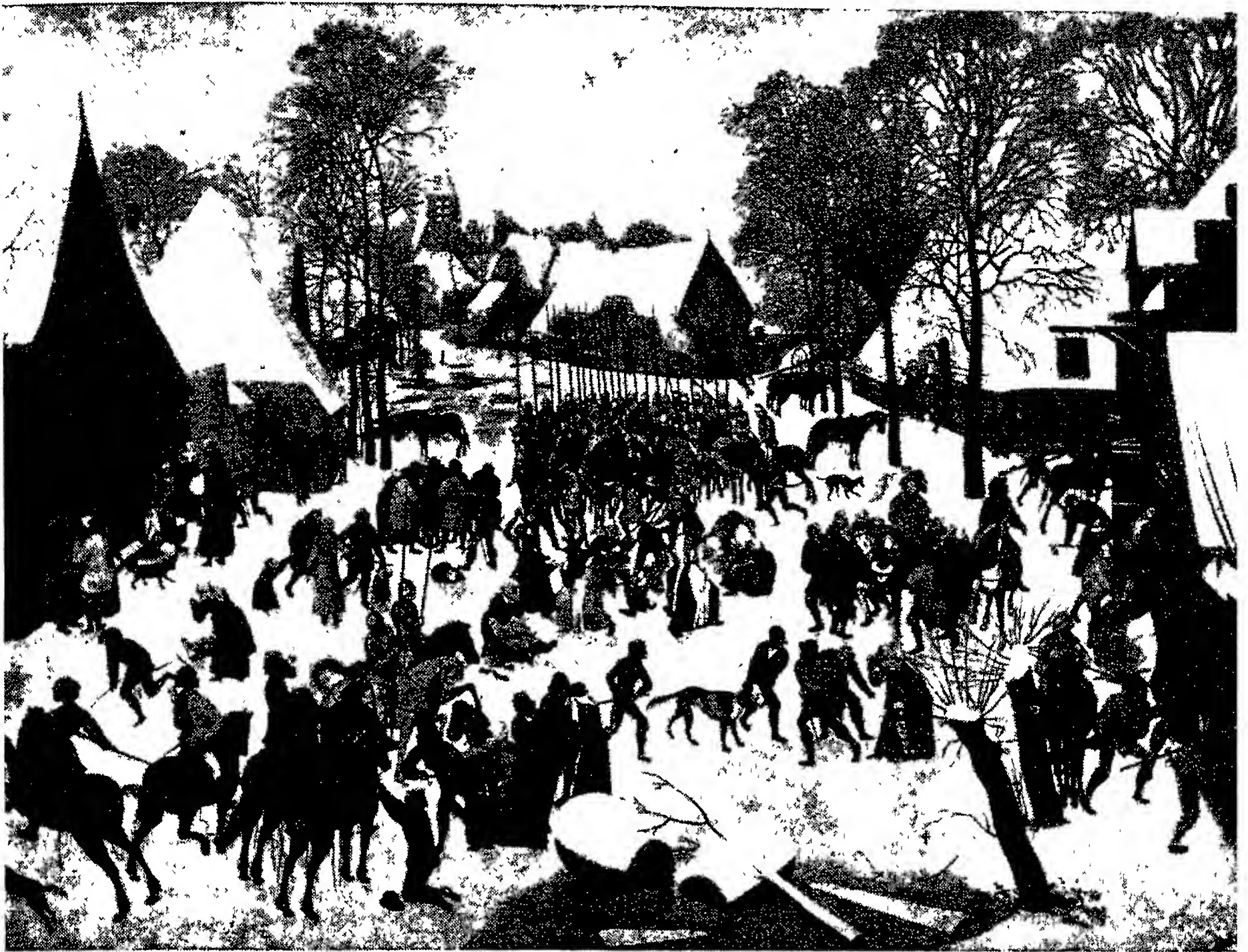
Flemish School OF PAINTING. Distinctive type of art which emerged in Flanders in the 15th century, particularly at Bruges, Ghent, and Antwerp. The earliest phases at the first two are still obscure. The first names to emerge are those of the Limburg brothers, illuminators, of Maaseyck. Next come the brothers van Eyck, Hubert (c. 1366–1426) and Jan (c. 1385–1440), usually considered the founders of the school and certainly its main inspiration. Their Ghent altar-piece, *The Adoration of the Lamb* (see illus. page 3227) begun by Hubert in 1420, completed by Jan in 1432, helped to establish the predominance of the Flemish style of painting in N. Europe. If they did not invent oil-painting, they were the first to reveal its full possibilities and so to improve its technique as to make it virtually a new medium; and this is one of the great contributions of the Flemish school to the history of art, though the

secret of the van Eycks' own perfection of the medium appears to have died with them.

Notable names among the following generation of painters are the so-called *Maître de Flammelle* (possibly Robert Campin), Jacques Duret, Roger van der Weyden, Dierick Bouts, and Petrus Christus. A little later were Hans Memlinc, Hugo van der Goes, Gérard David, and Quinten Matsys. These were all religious painters. Their contemporaries included Jerome Bosch, the earliest satirist, and Patinir, one of the first landscape painters.



Flemish School. *Madonna and Child Enthroned*,
by Dierick Bouts (c. 1410–75)
National Gallery, London



Flemish School. Massacre of the Innocents, by Pieter Bruegel the Younger, typical of detailed composition of the 17th century Flemish painters. This picture, in the museum at Brussels, is an exact copy of one by P. Bruegel the elder in Vienna.

In the work of these Flemish primitives the true Gothic spirit found expression. They record the intensity of the Gothic conception of the Christian drama, and reflect the desire for richness and elaboration of detail inseparable from the Gothic ideal. No Italian master rivalled them in this respect; nor, when Flemish technique was practised in Italy, could any southern painters attain their brilliance and delicacy. The Flemish technique, derived from missal illumination, was unsuited to the large demands of wall decoration which engrossed the Italian painters. But the influence of the Flemish masters of the 15th century on the art of Germany, Spain, and Portugal was important, and in England, especially in East Anglia, Flemish painters had considerable business.

A new phase entered with Jan Mabuse (1472-1532), who studied in Italy and introduced an alien note into the native vision. The rococo period of excessive elaboration with no compensation in the way of serious interpretation is represented by van Orley, Mostaert, and Engelbrechtsen; and rather more happily by Lucas van Leyden and Scoval. In this period the satirical genre picture, indi-

genous to the Low Countries and later developed by the Dutch painters, was first introduced, well-known examples being the Moneylenders and Misers of M. van Reymerwael. The greatest genre painter of the school, the last and

the most original of all the Flemish masters, was Pieter Bruegel (1526-1569), the only one to achieve a mural largeness of composition yet retain animation and human interest.

Flemish painting reached its full flowering in the 16th and

17th centuries. The emergence of its outstandingly exuberant and prolific genius, Pieter Rubens (1577-1640) and his pupils and disciples, the chief of whom was Anthony van Dyck. Notable masterpieces of this final period include Cornelis de Vos, portrait painter; Jan de Vos and his school, animal painters; Jakob Jordaens, best described as a Dutch Rubens; David Teniers, who might equally be called a Flemish Bruegel, whose work for



Flemish School. A Canon with Patron Saints, by Gerard David (c. 1450-1523), a pupil of Hans Memling. National Gallery, London.

link between the Flemish and Dutch genre painters.

It should be noted that until the clear emergence of a distinctive Dutch school at the end of the 16th century, Flemish art and Dutch art were running on parallel lines and no precise labelling of individual painters as Flemish or Dutch is practicable. This occasionally causes confusion, and use of the broader term "Netherlands school" does not help. It is perhaps simplest, as it is also broadly correct, to describe the 15th- and 16th-century genius as Flemish and that of the 17th century as Dutch. After the 15th century there was no Flemish school as such.

Bibliography. The Flemish School of Painting, A. J. Wauters, Eng. trans. H. Russell, 1885; Anciens Arts de Flandre, E. Durrand-Gréville, 1905; La Peinture en Belgique, H. Fierens-Gevaert, 1909; Art in Flanders, M. Rooses, 1914; Flemish Painting, E. Cammaerts, 1945.

Flensburg. Seaport of Schleswig-Holstein, Germany. It lies at the S. extremity of Flensburg Fiord, about 42 m. N.W. of Kiel. Beautifully situated on the steep shores of the land-locked fiord, it has a good harbour; its industrial works include shipyards, foundries, breweries, and bicycle factories. Whaling vessels leave annually for the Greenland fisheries. Originally founded during the 12th century, Flensburg has several fine old buildings, notably the churches of S. Nicholas (14th century) and S. Mary (13th century). Formerly a Danish town, it was entered by German troops Feb. 7, 1864, and annexed with Slesvig. It is in the southern part of that former duchy which chose to remain German after the First Great War. The shipyards and torpedo school were heavily bombed in the Second Great War. Here, after Hitler's death, Admiral Doenitz set up his "government," May 1, 1945; and here Doenitz, his "ministers," and the German high command were arrested, May 23, by the Allies. Pop. (est.) 68,000.

Flers-de-l'Orne. Town of France, in the dept. of Orne, on the Vère, 40 m. S. by W. of Caen. It has a 16th-century chateau, and cotton spinning, bleaching, and dyeing works. It was taken from the Germans by the British Aug. 16, 1944. Pop. (1954) 13,010.

Flers, ROBERT DE LA MOTTE-ANGO, MARQUIS OF (1872-1927). French dramatist. Born at Pont-l'Évêque, Nov. 22, 1872, and educated at Paris, he made his reputation as collaborator with

G. A. de Caillavet in a series of light and witty comedies. Among them are *Les Travaux d'Hercule*, 1901; *Primerose*, 1911; *L'Habit Vert*, 1912; *La Belle Aventure*, 1913. He became editor of *Le Figaro*, with Alfred Capus, in 1914; he resigned this post in 1920, rejoining the paper in 1922. He died July 30, 1927.

Fleshly School of Poetry, THE. Derisive name given to certain 19th-century poets, chiefly D. G. Rossetti and A. C. Swinburne. It originated in an article in *The Contemporary Review*, entitled *The Fleshly School of Poetry and Other Phenomena of the Day*, by Thomas Maitland (Robert Buchanan), which was afterwards published as a pamphlet, 1872. Swinburne replied in *Under the Microscope*, 1872. Buchanan later made a full *amende honorable* in regard to Rossetti's work.

Fletcher, ANDREW, OF SALTOUN (1655-1716). Scottish politician. Born at Saltoun (or Salton), Haddington, he was educated by the parish minister, Gilbert Burnet, afterwards bishop of Salisbury. He sat as a commissioner in the Scots convention of estates in 1678, and



Andrew Fletcher,
Scottish politician
After Aikman

vigorously opposed the government. In 1685 he joined Monmouth's expedition to England, but, having killed a man in a private quarrel, fled to Spain. He returned in 1688 with William of Orange and became a determined opponent of the Union. He is remembered by the remark from his *Account of a Conversation*, "I knew a very wise man, so much of Sir Christopher's (Sir Christopher Musgrave's) sentiment, that he believed if a man were permitted to make all the ballads, he would not care who should make the laws of a nation." Fletcher set up the first barley mill in the British Isles.

Fletcher, SIR BANISTER FLIGHT (1866-1953). British architect. Born in London, Feb. 15, 1866, he was educated at the Royal Academy schools and London University, at which he was lecturer and assistant professor (King's College) and university staff lecturer on architecture. President of the R.I.B.A., and for many years partner in the firm of architects which bore his name, he was knighted in 1919. He is best

remembered for his great *History of Architecture on the Comparative Method*—a standard work published 1896 and later translated into the chief European languages. His other books included a life of Palladio. He died Aug. 17, 1953.



Sir Banister Fletcher,
British architect

Fletcher, GILES (c. 1588-1623). English poet. Brother of Phineas and cousin of John Fletcher, the dramatist, he was educated at Westminster and Cambridge, and died rector of Alderton, Suffolk. His principal work, an allegorical poem entitled *Christ's Victory and Triumph*, 1610, was modelled on Spenser's *Faerie Queene*, and influenced Milton.

Fletcher, SIR HENRY (1727-1807). British politician and administrator. Born in Cumberland, he served the E. India Co. from boyhood in capacities ranging from sea-captain to director, 1769-87, and chairman, 1782-83. Whig M.P. for Cumberland, 1786-1806, he received a baronetcy in 1782. He supported Fox's proposals for administrative reforms in India and Grey's measure for parliamentary reform, and was highly regarded for his personal character and liberality. He died March 25, 1807.

Fletcher, JOHN (1579-1625). English poet and dramatist. Son of Dr. Richard Fletcher, bishop of London, he was born at Rye, and educated at Bene't (Corpus Christi) College, Cambridge. On his father's death being left with out means, he took to writing for the stage, beginning about 1607 his famous collaboration with Beaumont (see Beaumont, Francis) in plays which introduced tragi-comedy to the English theatre. Independently he wrote fifteen or sixteen plays, including *The Faithful Shepherdess* (a charming Dresden-china pastoral play), *Bonduca* and *Valentinian* (tragedies), *A Wife for a Month* (tragi-comedy), *The Wild Goose Chase*, *Monsieur Thomas*, *Woman's Prize* (a sequel to *The Taming of the*



John Fletcher,
English dramatist
From an old engraving

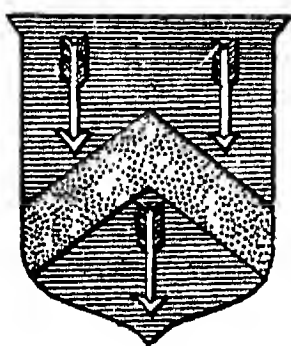
Shrew), and *The Chances* (comedies). He also collaborated with Massinger, Middleton, Rowley, and perhaps others.

To what extent Fletcher was responsible for *The Two Noble Kinsmen* and *Henry VIII* remains a vexed question. He wrote beautiful lyrics and some of the raciest dialogue in English dramatic literature. His characteristic line of eleven syllables (the extra syllable being often needlessly appended) gives on first hearing an impression of conversational naturalness and ease, but it easily becomes monotonous, flaccid, and almost indistinguishable from prose. The frequency of its occurrence is commonly used as a criterion by which to determine Fletcher's share in collaborated plays. He died of the plague and was buried Aug. 29, 1625, in S. Saviour's, Southwark. Consult John Fletcher, O. L. Hatcher, 1905.

Fletcher, SIR LAZARUS (1854-1921). A British mineralogist. Born at Salford, March 3, 1854, he was educated at Manchester grammar school and Balliol College, Oxford. Appointed a demonstrator in the Clarendon Laboratory, he remained lecturing in Oxford until 1890, when he became keeper of minerals in the natural history department of the British Museum. He was promoted director of the department in 1909, and resigned in 1919. In 1916 Fletcher was knighted, and his many honours included the F.R.S. From 1888 to 1909 he was secretary of the Mineralogical Society. He wrote *Introduction to the Study of Minerals*, 1884; *Introduction to the Study of Rocks*, 1895. He died Jan. 6, 1921.

Fletcher, PHINEAS (1582-1650). English poet. Phineas was brother of Giles Fletcher and, like him, an imitator of Spenser. He died rector of Hilgay, Norfolk. His works have been edited by Grosart, 1868, the most important being a poem of 4,800 lines entitled *The Purple Island*, an extraordinary allegory of the human body.

Fletchers' Company, THE. City of London livery company. Of ancient origin and associated with

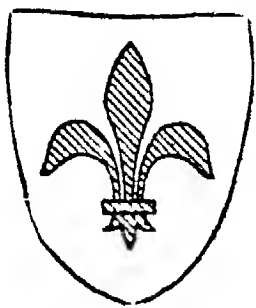


Fletchers' Company arms

the Bowyers, the Fletchers (Fr. *flèche*, an arrow) is a company by prescription, not charter, was granted arms in 1427, and possessed a hall in St. Mary Axe until 1930. The

earliest extant records are dated 1775. The office is at 7 Crompton Way, Manor Royal, Crawley.

Fleur-de-Lis (Fr., lily-flower). In heraldry, an extremely ancient symbol. Found among Egyptian hieroglyphics and used by the Anglo-Saxon kings, it was probably a conventional representation of some such flower as the lotus, riverside flags, or the iris. It consists of a central bulbous



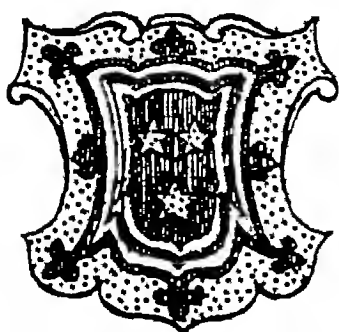
Fleur-de-Lis in heraldry

petal and two side-curving petals, a fillet and a stalk, usually triparted. The fleur-de-lis, an early cognizance of the Carolingian kings, became identified with the royal houses of France, who bore the golden flowers on a blue shield.

At first the shield was strewn with the lis, but occasionally only three appeared, some say in allusion to the Holy Trinity, a fashion which became permanent under Charles VI. The French arms (azure, semée de lis d'or) was quartered with the arms of England by Edward III; Henry IV reduced the number of lis to three, and after the treaty of Amiens and the Union with Ireland in 1801, the French quartering was omitted from the arms of the English royal family. *Pron.* Fler-de-leess.

Fleurus. Town of Belgium, in the prov. of Hainault. It stands in a plain, 8 m. N.E. of Charleroi, and is a junction for the rly. to Gembloux, Landen, and Nivelles. There is a steam tramway to Namur. Four important battles have been fought near this small Belgian town. In the first the duke of Brunswick defeated the Spaniards under Cordova, Aug. 29, 1622. Under Marshal Luxembourg the French gained a victory over the allied Spanish, Dutch, and Germans, July 1, 1690. On June 26, 1794, the French under Jourdan inflicted a crushing defeat upon the Austrians and forced them to evacuate Flanders. Napoleon here defeated the Prussians, June 16, 1815, in the battle usually known as the battle of Ligny (*q.v.*).

Fleury, FLORY, OR FLOWERY. In heraldry, any charge decorated



Fleury, in heraldry

with fleur-de-lis. Examples are crosses at the ends of the limbs or in the angles, on the tressure, and on sceptres, etc. See *Cross illus.*

Fleury, ANDRÉ HERCULE DE (1653-1743). French statesman. Born at Lodève, Hérault, June 22, 1653, he was educated at Paris, took holy orders, and became chaplain to Louis XIV, who made him bishop of Fréjus in 1698, and tutor to the future king Louis XV. In 1726 he became chief minister of the latter and was appointed cardinal. His administration was upright and strictly economical, but he did nothing to check the early dissipations of the king or the abuses of the farmers-general.



de fleury

After Rigaud

His foreign policy was directed chiefly towards ensuring peace, and to this end he worked closely with the English minister Walpole. The French intervention in Polish affairs in 1733 was undertaken against his better judgement, but he failed to prevent France from being involved in the war of the Austrian Succession, 1740, and died discouraged and in ill-favour, Jan. 29, 1743.

Fleury, CLAUDE (1640-1723). French church historian. Born Dec. 6, 1640, in Paris and educated there, he practised for nine years as an advocate, and then devoted himself to theology. In 1672 Louis XIV entrusted him with the education of the young princes, and he became nominally the abbot of Loc-Dieu and later prior of Argenteuil. From 1691 he was writing his *Ecclesiastical History* in 20 volumes. He died July 14, 1723.

Flexner, SIMON (1863-1946). American pathologist. Born of Jewish parents at Louisville, Ky., March 25, 1863, he was educated at Johns Hopkins university, Baltimore, at which he became assistant to the professor of pathology, 1895. In 1899 he was appointed professor at Pennsylvania university. Joining the Rockefeller Institute, New York,

as director in 1903, he held the position until 1935. Here he studied bacteria, germs, and serums, made experiments in the pathology of toxalbumin intoxication, produced in 1905 a serum against cerebro-spinal meningitis, and discovered the dysentery bacillus. He died in New York, May 2, 1946.

Fliegende Blätter (Ger., flying leaves). German humorous weekly paper, founded in 1844. It had little political satire from 1856, but excellent cartoons and stereotyped objects of jokes: the mother-in-law, the naughty little boy, the dandy, the arrogant lieutenant of the Guards. In 1928 it was merged with the *Meggendorfer Blätter*, a similar family paper printed in colours. Both periodicals were published at Munich. The paper lapsed during the Nazi period.

Flight. Movement through the air. As developed by man, it is described under Aeronautics and related articles. Among animals, a number of groups, the most important being the pterodactyls, the birds, the bats, and the insects, developed the power of flight.

The pterodactyls were not very well designed for flight, for their immense wings were held out by one greatly elongated finger on each side, and also involved the hind legs, which led to great clumsiness, especially when the animals tried to land. They flourished for a time and then died out.

Insects are the only invertebrates which have evolved true flight. Their wings are not limbs but are outgrowths of cuticle from the thorax. They normally fly by continuous flapping rather than by gliding and soaring. The flapping rate is high, from five per sec. by some large butterflies to about 1,000 per sec. by small midges. Some insects have two pairs of wings which in certain species beat in unison, in others (*e.g.* dragonflies) alternately. In many beetles one pair has developed as covers of the other (functioning) pair.

It is generally accepted that the dragonflies are the fastest fliers among insects—some of their species may be capable of 50 m.p.h. Horse-flies can do 30, honey-bees up to 15 m.p.h., while the locust can manage only 10, and the mosquito only 3 m.p.h. Many small weak-flying insects are carried to great heights by convection currents, and are then drifted considerable distances. Aphides are dispersed in this way over large areas. By the use of traps carried by aircraft and on the cables of

captive balloons it has been found that such insects may be caught at heights of three miles, and that they may be carried as far as 500 m. in three-four days.

Many strong-flying insects also fly great distances; for instance, butterflies of several species cross the English Channel every year. The Painted Lady butterfly breeds along the shores of North Africa during the winter, and in spring many start to fly north across the Mediterranean and over Europe. Many reach Great Britain in June, and stragglers have reached Iceland. The same species breeds in Mexico and flies as far north as Newfoundland, a distance of 3,000 m. The Monarch butterfly of North America makes a similar spectacular flight from Central America up to Canada. Individuals marked in spring during the northward flight have been recaptured making the return journey during the autumn. A number of specimens have found their way across the Atlantic to Europe, though there is evidence to show that some at least have come in ships.

FLYING FISHES. Several species of fish have evolved in such a way as to enable them to escape from their enemies by taking to the air. In *Cypselurus*, the most fully adapted, the pectoral fins are greatly enlarged, with a span of about 10 ins., the pelvic fins are similarly though less developed. These fins lie along the sides of the fish when it is swimming, but are held out rigidly when it is flying.

Flight among Fish

When taking off the fish breaks surface at about 20 m.p.h., expands its fins, and then accelerates along the surface, driven by a very rapid vibration of the tail, the greatly developed lower lobe of which is still in the water. In less than a second the fish reaches over 40 m.p.h. and takes off into a glide, the usual duration of which is about three seconds, so that it covers about 50 yards. When wind is being deflected upwards by striking waves, favourable conditions may be created to enable them to make much longer flights of 200–300 yards, and to attain a height sufficient to land them on a liner's deck.

BATS. A few groups of mammals have achieved passive or gliding flight; such animals have a fold of skin which can be stretched between the fore-limb and the hind limb on each side to provide a supporting surface. By climbing

to a height in a tree and launching forth they can make quite long glides, but no power is applied during flight so that all such flights are of very short duration. Only the bats among the mammals have been completely successful in achieving true flight. That this has been a great advantage to them is shown by the fact that there are very many species, chiefly in the tropics. Only the rodents have more species. The wings consist of two layers of skin, back to back, held out by the greatly elongated finger-bones and attached also to the hind legs. This involvement of the hind limbs with the wings is the main disadvantage that bats have as compared with the birds. In other ways bats and birds show parallel evolution; their breast muscles are similar and they are attached to similar keels on their breast-bones. Bats are more agile in flight than are birds, owing to their extreme lightness. They usually take off from a height, but they can jump up from a level surface. They are extremely agile in landing into an inverted hanging position.

Echo-Sounding Bats

The most extraordinary feature of the flight of bats is their development of an echo-sounding technique for the avoidance of obstacles. As the bat flies along it emits a succession of short pulses of sound of ultrasonic frequency. The echoes received by the bat's highly developed ears enable it to locate obstacles in its path. (The Guacharo or oil bird, a South American species, has developed the same method to enable it to fly to its nest in dark caverns.)

BIRDS. It is probable that birds evolved from reptiles which ran on their hind-legs, waving their fore-limbs to aid balance. Large scales, developed along the trailing edge of the fore-limb, may have gradually evolved into feathers. It has been suggested that feathers were evolved primarily for heat-conservation, and that their use for flight came later.

The bird's wing is its fore-limb, with the usual bones much modified. Most of the handbones have disappeared. The long bones are tubular, which gives them great strength with light weight. The principal flight feathers are the primaries, ten in number, which spring from the hand part of the fore-limb and are used mainly for propulsion. The inner part of the wing has a number of secondary

feathers which form the trailing edge of the wing. The spaces between the main flight feathers are filled by smaller feathers which overlap one another and so form a smooth surface to the wing.

The thumb of the wing has a small tuft of feathers, the alula or bastard-plume, which acts as an anti-stalling device, forming a slot on the leading edge when needed. At the wing-tips the primary feathers are more or less cut away to form more slots, the depth and numbers of which vary from species to species, being found most developed in game birds and the birds of prey, and scarcely at all in birds, such as shearwaters, with long, narrow wings. These slots form the twisted primary feathers into a series of driving surfaces in game birds. The twist which the primaries have during the down-stroke is caused by the shaft's being nearer to the leading edge than to the trailing edge. In birds in which the primary feathers do not separate so much, the whole wing has a slight twist during the down-stroke. This twist causes the air to be driven backwards and downwards, and the reaction to this is that the bird is driven forwards and kept up.

A bird must flap if it is to maintain height and speed. If it glides it can either maintain height by losing speed, or maintain or even increase speed by losing height. The muscles which flap the wings are attached to the keel of the

little as 8 p.c., e.g. in an owl. The possession of large muscles does not by itself indicate that the bird is a good flier; it may mean that the bird's wings are of such an inefficient shape that only by possessing large muscles can it overcome this disadvantage. A study of the weights of these muscles and of their sizes relative to one another sheds much light on the bird's method of flight.

During flight other smaller muscles can alter the shape of the wing in a number of ways; this gives the bird many degrees of freedom not found in man-made flying machines.

The tail consists of a number of feathers, usually 12, which can be opened and closed like a fan. There are muscles also which can raise, lower, or twist it, or make it concave on either the upper or lower surface. Tail size varies from those of the grebe family which are virtually non-existent to those of birds like pheasants and pigeons. In general those birds which need to be highly manoeuvrable, such as birds living among trees or which catch insects, have large tails. Birds living in open spaces have small tails. Tails vary greatly in shape from pointed to square-cut to forked.

The function of the tail is to act as an accessory supporting surface for use when manoeuvring, and it is not normally used when the bird is flying in a straight line.

The bird must attain a certain air-speed before it can become airborne; some run into the wind, some dive from tree or cliff, small birds manage with a jump and a vigorous flap. Some birds, such as the albatrosses, cannot take off in the absence of wind and must wait until conditions are right. Cormorants which have eaten too much may have to vomit part of their catch before they can take flight.

Birds land into the wind whenever possible, so as to reduce their ground-speed while keeping their air-speed high. They lose speed by flapping vigorously against the direction of motion and then by stalling completely.

A gliding bird loses height steadily relative to the air, but if



Flight. Cuckoo on the wing

the air is rising at a speed greater than the rate at which the bird is sinking, then the bird will rise relative to the ground below. Many birds take advantage of rising air to help them to maintain height without effort.

Vultures, most of which are found in hot countries, are the best adapted for gliding in rising columns of hot air. They have very large wings which have long slots at the tips, and this adaptation enables them to have a small sinking speed. At night vultures sit on the ground or in trees, but when the sun rises they take off clumsily, for they have very small wing muscles, and seek a thermal, i.e. an area where hot air is rising. Once in a thermal they circle, rising in a spiral to about 5,000 feet where they continue to soar till the evening, when they are forced to come down again. This method of flying without effort suits the vulture's way of life, for its meals are by their nature intermittent, but when found may be so abundant that the bird is unable to take off.

In Great Britain buzzards, rooks, gulls, and many others may be observed using this method: they find hot air rising from bare ground, or even roof-tops, heated by the sun.

Soaring can be seen also in air which has been deflected upwards by wind striking a hill or cliff. Slope-soaring, as this is called, is often of great help to birds which have to migrate along mountain ridges. The albatrosses of the southern ocean have developed a wonderful method called dynamic soaring which enables them to fly long distances without effort. This depends on there being a wind gradient, that is to say on the lower layers of the air being slowed



Flight. A gannet landing

breast-bone. The two main ones are the Pectoralis major, which pulls the wing down; and the Pectoralis minor or Supracoracoideus, which pulls the wing up again. The first is much larger; the two together may make up over 30 p.c. of the bird's weight in a strong flier (e.g. a pigeon), or as

down by friction, so that layers of fast moving air are to be found immediately above layers of slower air. The albatross glides rapidly down-wind, losing height, and when it has almost reached the water-level it turns and shoots up into the upper faster layer again. The mechanics of this method is difficult to explain, but there is no doubt that the albatross finds it an economical way of flying. Only birds which are big and heavy, with very long narrow wings, can fly in this way.

Flying birds vary in weight from humming birds, some species of which weigh as little as a twelfth of an oz., up to swans and bustards, some of which weigh as much as 35 lb.; variations in the weight of individuals of the same species are slight. Birds quickly reach maximum size. The wandering albatross possesses the greatest wingspan—up to a little over 11 ft.

Speed of Bird Flight

As regards speed, a large bird dropping from a height might reach a little over 100 m.p.h., but in level flight such a speed cannot be attained. Falcons and swifts, perhaps the fastest, can probably fly at well over 60 m.p.h.; most small birds cannot reach more than 20 m.p.h. Many birds have a cruising speed and a much greater emergency speed which can be kept up for a short time only.

Though birds have been seen flying near the tops of high mountains, they do not generally fly at any great height above the ground. In Great Britain lapwings and rooks are the most likely to be seen flying high.

Several land birds have been proved to cross up to 2,000 miles of ocean on their migrations to remote islands, showing great powers of endurance and even greater powers of accurate navigation. The arctic tern, which nests in Spitsbergen 600 m. S. of the North Pole, is found during the northern hemisphere winter at the edge of the pack ice round the Antarctic continent—a round journey of 20,000 m. each year. Sometimes birds are forced to make long flights through being drifted out to sea by wind and then having to carry on till they reach land. A famous instance is that of a flock of lapwings which took off one winter evening from the north of England en route for Ireland. There was a tail wind of about 55 m.p.h. and so they over-shot their destination and, carrying on, reached Newfoundland.

Flight Lieutenant. Commissioned officer in the R.A.F. The rank is equivalent to lieutenant in the Royal Navy and captain in the army. The rank was originally introduced into the Royal Naval Air Service (*q.v.*); when adopted by the R.A.F. it was at first held only by officers engaged in flying duties, but later was held in all branches of the service. Rank is indicated by two spaced rings on the sleeve of the tunic or on the epaulettes of the greatcoat.

Flight Mechanic. Tradesman in the R.A.F. responsible for the overhauling of aircraft engines or aircraft frames on the ground. Flight mechanics either enlist in the service as fully qualified tradesmen or join as boy apprentices.

Flight Sergeant. Non-commissioned officer in the R.A.F., or in the R.A.F. Regiment. He may be engaged in flying or in ground duties. He ranks above a sergeant and below a warrant officer, and is equivalent in rank to a staff sergeant in the army or petty officer in the Royal Navy. Rank is indicated by three stripes surmounted by a crown worn on the sleeve of the tunic.

Flinck, GOVAERT (1615-60). Dutch painter. Born at Cleves, Jan. 25, 1615, he was one of Rembrandt's most successful pupils. His earlier work, painted under the influence of the master, is of greater value than his later Italianate style of court painting. Notable works are *The Annunciation to the Shepherds*, Louvre; *The Grey Bearded Man*, Vienna; *The Expulsion of Hagar*, Berlin, painted for the elector of Brandenburg; *The Civic Guard Fête*, Amsterdam. He died at Amsterdam, Feb. 2, 1660.

Flinders. River of Queensland, Australia. It issues from Mt. Courtney in Douglas co., and flows S.W., W., and then N.W. for a total course of over 300 m., to discharge into the Gulf of Carpentaria, 10 m. S.W. of Kimberley. It was named after Matthew Flinders (*v.i.*), the navigator.

Flinders, MATTHEW (1774-1814). British sailor. Born March 16, 1774, at Donington, Lincs, the son of a surgeon, in 1790 he went to transplant bread-fruit trees from the South Sea Islands to the W. Indies. Returning in 1793, he was posted to the *Bellerophon*, saw action on the *Glorious First of June* (1794), and sailed in the *Reliance* to New South Wales, where he began a series of explorations lasting until 1799, circumnavigating Tasmania, which was hitherto supposed to be part of the mainland.

In 1800 Flinders was appointed to the *Investigator*, and again sailed (1801) for Australia, where he charted the Gulf of Carpentaria, and surveyed the coast of New Holland. On his voyage home, unaware that Great Britain and France were at war, he was detained by the French at Mauritius, and imprisoned, 1803. In 1810 he was released and made his way to England, where he wrote an account of his discoveries. He died July 19, 1814. His name survives in a river of Queensland, a mt. range of S. Australia, a bay of W. Australia, and an island N. of Tasmania.

Flindersia. Small genus of evergreen trees of the family Rutaceae. Natives of Australasia and the Moluccas, they have hard, close-grained wood of a yellow tint, useful for many purposes. *F. australis* (Crow's Ash), found in Queensland and New South Wales, grows to a height of 60 ft., with smooth, flaking bark, and alternate leaves broken into three to six oblong leaflets. The numerous small white flowers are in dense clusters. The wood is very durable. The trees are named after Matthew Flinders (*v.s.*).

Flinders Range. Mt. system of South Australia. It runs N.N.E. for about 200 m. from Spencer Gulf between Lakes Torrens and Frome, attaining 3,900 ft. in St. Mary's Peak. Uranium has been found in Mt. Painter.

Flin Flon. Town of Manitoba, Canada. Near the border of Saskatchewan, in lat. 55° N., it is a branch terminus of the C.N.R. and also served by airway. A mine at Flin Flon Lake has a daily output of 6,000 tons of high grade copper sulphide; power comes from Island Falls on the Churchill River, 56 m. to N.W. The opening of this pre-Cambrian area has transformed Manitoba from a purely agricultural to a partly industrial province. Pop. (1951) 9,899.

Flint. Crystalline mineral composed mainly of silica; a variety of chalcedony. It is compact, almost opaque, usually dark grey or brown, somewhat harder than steel, and breaks with a shell-like fracture, forming sharp-cutting edges. When first unearthed it is brittle, becoming toughened by



From an engraving

exposure. Chert and hornstone are coarser forms.

In Great Britain and W. Europe flint occurs mainly in the middle and upper chalk formations, where it forms irregular nodules, tabular masses, and veins. It is also scattered through Tertiary gravels and alluvial soils, sometimes in great quantities, derived from disintegrated chalk rock. The nodules, sometimes several feet across, are often the silicified remains of sponges, or are hollow shells formed by the concretion of gelatinous silica around urchins, sponges, and other marine organisms. When this dense, non-crystalline constituent, the cause of black flint, is removed, white flint results. The veins were deposited in joints and fissures in chalk rock, carbonate of lime being displaced by dissolved silica of organic origin.

The cutting edge produced by flaking enabled Palaeolithic man to invent edged tools, before the introduction of metallurgy. Utilising at first water-worn pebbles or cliff-exposed nodules, this industry led to flint-mining. The discovery that sparks are produced when flint is struck with iron pyrites brought about the percussive method of fire-making. In chalk districts of England flint was used in medieval times for building, walls being made of undressed or of split flints, and porches and battlements panelled with squared flints, sometimes in beautiful colour zones. The secret of splitting flints has been lost. As road metal flint is unsatisfactory because of its readiness to pulverise. Some flint is used for pottery and optical or flint-glass. A white quartz is obtained by heating flints and throwing them into cold water. In France they are crushed and exported. In the English home counties S. of the Thames and in Belgium there is a large output, much used in pottery. *See also* Flint Implements.

Flint. Borough and county town of the county of Flint, Wales. It stands on the S. shore of the Dee estuary, 12 m. N.W. of Chester. It was once an important harbour, but the accumulation of sand in the estuary keeps the tidal waters away from the town. Hundreds of acres of marshland in the estuary could be profitably reclaimed. Artificial silk is made here. There are lead and coal mines in the neighbour-

hood. The castle, built by Edward I, was the scene of the meeting between Richard II and Bolingbroke, described by Shakespeare, and was twice captured by Parliamentarians and dismantled in 1647; the remains were taken over by the office of Works in 1920. There is a busy, open-air market every Friday. Pop. (1951) 14,267.

Flint. City of Michigan, U.S.A., the co. seat of Genesee co. It stands on Flint river, 70 m. by rly. N. by W. of Detroit, and is served by rly. and an airport. Ranking second in the world to Detroit in production of motor cars, Flint contains the plants of several subsidiaries of General Motors. It developed this prominence from an earlier output of buggies, carriages, and carts. Flint trebled its population during 1900-10. Other manufactured goods include iron products, bricks and tiles, cigars, and flour. Pop. (1950) 163,143.

Flint. River of Georgia, U.S.A. Rising in the N. part of the state, it flows 350 m. generally S.W. to unite with the Chattahoochee in forming the Apalachicola. Navigable for most of its length, it drains an area of 8,000 sq. m. A dam serving a hydro-electric power plant was completed on the river, 6 m. W. of Cordele, in 1930.

Flint, SIR WILLIAM RUSSELL (b. 1880). British painter. Born in Edinburgh, April 4, 1880, he was educated at Daniel Stewart's College, and Royal Institution school of art there. He came to London in 1900, and was on the staff of *The Illustrated London News* 1903-07. At his best as a water-colourist and etcher, he became widely known through his illustrations to various limited editions, e.g. Chaucer, Homer, Malory, and Charles Kingsley's *The Heroes*.

Elected A.R.A. 1924, R.A. 1933, he was president of the Royal Society of Painters in Water Colours 1936-56. He excelled in depicting the female form in sunlight. He was knighted in 1947.



Sir William Russell Flint, British painter

Flint Implements. Tools and weapons made from flint by early man; they are found all over the world. The name is also popularly extended to include implements made from other types of stone (e.g. obsidian or chert, quartz or

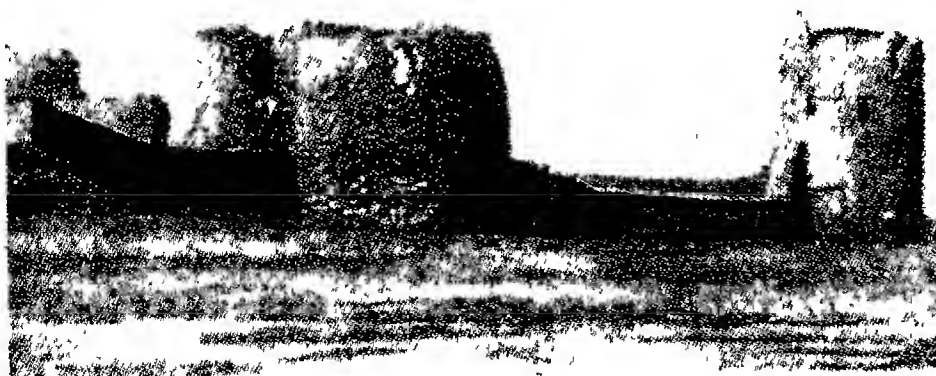


Four on a Beach, a typical water-colour painting by Sir William Russell Flint

granite) sometimes used by Stone Age man. In Britain and much of Europe flint was more frequently used than any other kind of stone.

The best flint used by Stone Age man came from the deposits (usually chalk) in which it was formed. Flint from secondary deposits, e.g. the gravels laid down by rivers, was more difficult to work since during its deposition it had usually been exposed to extreme temperature changes, rendering it brittle, or battered and rolled, producing incipient cracks; it was frequently used, but the proportion of waste flakes and broken tools was greater.

Flint is worked, and implements are made, by turning to advantage the characteristic conchoidal fracture of the material. When pressure is applied to a flint block, either steadily or by a sharp blow, the force does not travel through the block in the direction in which it is applied, but radiates in the form of a cone. By controlling the direction of blow or pressure and the force with which it is applied, a man can obtain fragments of desired shape and size. Such fragments are classed as cores.

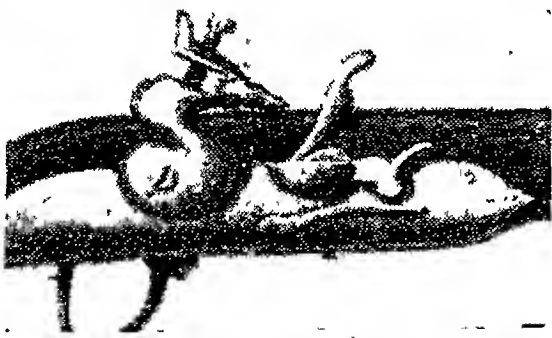


Flint, Wales. Ruins of the castle built by Edward I

flakes, chips, or splinters. Man-made fragments are identified by the evidence of direction of flaking and uniformity of weathering of fractured surfaces, and by the presence of bulbs of percussion where the force has been applied.

Palaeolithic workshops—with anvil stones, hammer stones, discarded cores, spoiled implements, and waste flakes—are plentiful, e.g. at Crayford, Kent, and Caddington, Beds. Early Neolithic sites are to be seen at Campigny and Grand Pressigny, France; later workshops in Britain are at Grovehurst, Kent, and Graig Lwyd, Penmaenmawr, N. Wales. It is likely that many implements were made as they were required by individuals away from these centres, since the working occupies only a few moments. Early flint mines have been found at Spiennes, Belgium; Cissbury Hill, Sussex; and Grime's Graves, Norfolk.

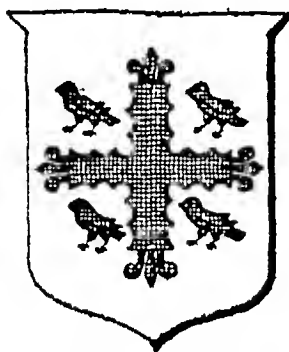
Flint Lock. Firing mechanism used on muskets before the introduction of percussion cap cartridges. The flint lock consists of a metal hammer engaged with a trip on the trigger; a flint fixed to the side of the lock; and a small flash pan containing the priming powder. The flint lock is cocked by pulling the hammer to the rear, where it is held by the trigger trip; when the trigger is pressed, the hammer flies forward and strikes the flint, causing a shower of sparks to fall in the flash pan and ignite the priming. The flash pan was usually provided with a cover



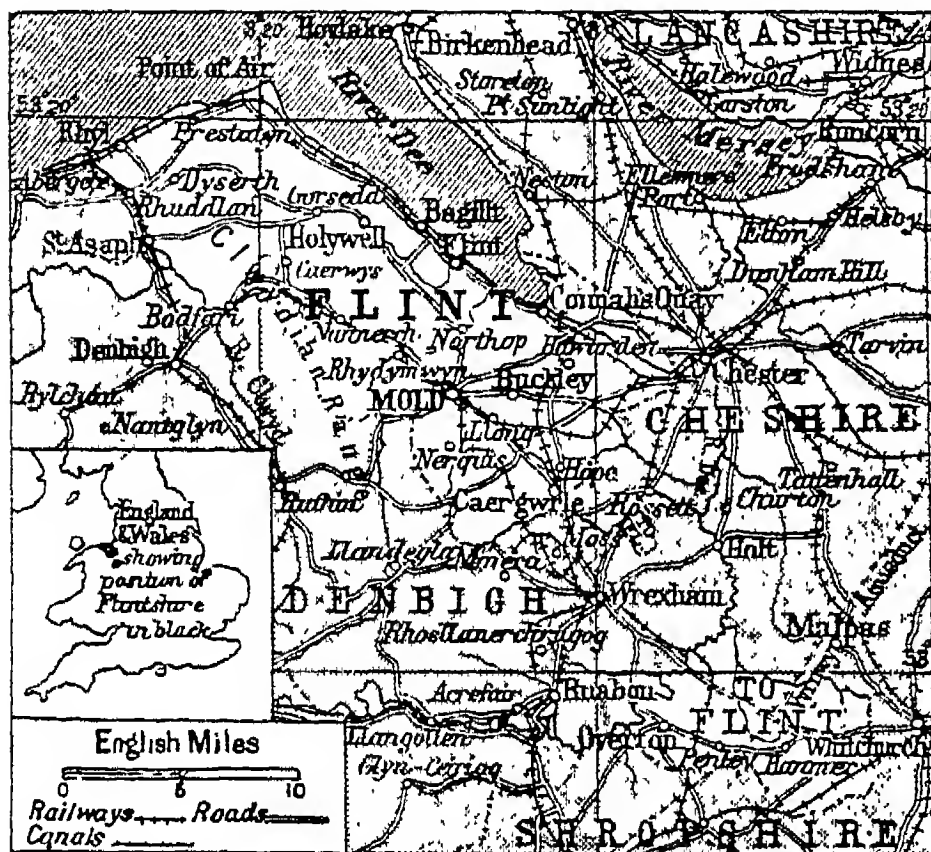
Flint Lock. Mechanism of firing device of a 17th century musket

to prevent the priming falling out and getting wet. In some types the cover was automatically raised from the flash pan when the lock was cocked. The flint lock was invented by the Portuguese about 1600, having been developed from the Japanese tinder box. In 1630 it was adopted in France, where it was called *fusil* from *fusile*, a flint. It was introduced into England in the reign of William III, and was the standard British infantry weapon until displaced by the percussion cap in 1840. Early flint locks fired one round every 2½ min., later types up to 12 rounds.

Flintshire. Northern maritime and the smallest co. of Wales. It lies to the W. of the Dee estuary, with a detached portion situated E. of Denbighshire; area, 256 sq. m. A hill range partly crosses the co. parallel to the Dee estuary, which at low tide is a sandy waste. The co. contains the lower courses of the Dee and Clwyd; there are several valleys of considerable beauty, and in these the soil is fertile and under cultivation. Dairy and sheep farming also prosper. Coal, lead, iron, and other minerals are worked. There are iron and steel works along the Dee estuary; artificial silk and flannel are manufactured; and there are cement-making works. Mold is the administrative h.q.; Rhyl and Prestatyn are resorts; Flint, Buckley, Connah's Quay, and Holywell are other towns. Flint and Rhuddlan have ruined castles, built by Edward I. The county, most of which is in the diocese of St. Asaph, forms two co. constituencies. Pop. (1951) 145,279. Consult History of the Diocese of St. Asaph, D. R.



Flintshire arms



Flintshire. Map of this Welsh county showing the detached portion between Cheshire and Shropshire

Thomas, 1908-13; Ancient Monuments in Wales and Monmouth, publ. Royal Commission, 1912.

Flintshire Lead Process. A reduction process which has been used from remote times in N. Wales. Pure ores obtained from limestone formations are used. The furnace is of the reverberatory type, having the hearth sloping to a central well, from the bottom of which a tap hole drains to a pot outside. A preliminary roasting of the charge on the hearth is followed by a raising of the temperature till the lead begins to run freely, then by a further rise to melt the charge down, the introduction of lime, stirring and mixing, a further roasting, draining, the introduction of a little coal slack to finish, and the tapping out of the metal. See Lead.

Floating Battery. The guns mounted on a ship or barge for bombarding shore positions from the sea. In the Second Great War floating batteries of rocket guns carried on special self-propelled barges were used to saturate the beach defences preparatory to the infantry landing in Normandy. See Rocket Weapons.

Floating Debt. Term used in national finance. The national debt of the U.K. may be classified into funded debt, not repayable on any definite date, and unfunded debt, repayable on a definite date. Of the unfunded debt, that part issued for a period of less than a year is called the floating debt. It consists of treasury bills, treasury deposit receipts, and ways and means advances. Treasury bills are usually for three months and are offered for tender periodically or sold continuously. T.D.R.s are for six months and now appear as one of the most important assets in the balance sheets of the big banks. Ways and means advances represent the current overdraft of the state. On March 31, 1946, the national debt was roughly £23,637 millions, of which the floating debt was £6,487 millions, made up of treasury bills, £4,423 millions; T.D.R.s, £1,559 millions; ways and means advances, £505 millions. See National Debt.

Floating Island. Floating mass of peaty vegetable materials, which collect in the shallower parts of the floor of a lake, and are probably bouyed up by the gases of their decomposition.

Floating Kidney. Condition in which the kidney is abnormally mobile and can be moved within the abdomen by manipulation.

Lesser degrees of the condition are known as palpable kidney and movable kidney. Common causes of floating kidney are alterations in pressure due to loss of fat; repeated pregnancies; and a general sagging down of the viscera known as *enteroptosis*. Mild cases can be treated by suitable corseting and bandaging of the abdomen. Serious cases need surgical attention.

Flocculi (Lat. *floccus*, a lock of wool). Markings bright or dark on photographs of the sun taken in the light emitted by one kind of element, *e.g.* hydrogen. See Sun.

Flock (Lat. *floccus*, a lock of wool). Material used for stuffing beds, cushions, and upholstery, and consisting of either wool waste recovered during the finishing operations of milling, shearing, and raising woollen fabrics, or of the fibres produced by "breaking" worn woollen rags and waste yarn, *i.e.* tearing them into their constituent fibre by machinery. Flock is obviously liable to contamination with dirt and even infectious material.

Under the Rag Flock Act, 1911, amended 1928, flock from rags of old or new cloth must meet a standard of cleanliness prescribed by the ministry of Health. See Wool.

Flock Book. Register of sheep. Special societies, dealing with almost every variety of sheep, publish a flock book in which all pure-bred animals belonging to members are registered and the points of the breed laid down officially. See Sheep.

Flodden, BATTLE OF. Fought between the English and the Scots, Sept. 9, 1513. Flodden is a ridge of the Cheviots on the English side of the border. It is 3 m. S.E. of Coldstream, and nearer is the village of Branston. Along it runs the road to Scotland, and near is the Till, flowing to join the Tweed.

Suddenly renewing the war with England, James IV crossed the border on Aug. 22 with a large army and besieged Norham Castle, Surrey, charged with defence of the realm while Henry VIII was fighting in France, collected an army, and marched N., learning on the way that Norham and other castles had fallen to the invader. On Sept. 7 the two forces were only a few miles from each other. Surrey, by a circuitous march, placed his vanguard between the enemy and their line of retreat. The rest of the army moved on an interior line and on the afternoon of the 9th, were ascending the ridge

whereon the Scots stood—but from the N., not from the S.

Seeing the enemy, James led his men down the ridge to meet them, and the battle was joined at once. Gradually the English gained the upper hand, and the Scots on the wings were soon in flight. On both sides the centre, picked soldiers under James and Surrey respectively, stood to fight it out. It was an unequal duel, for other bodies of English closed round the Scots, who were charged by horsemen from the rear, and when their king was killed they had decisively lost the battle.

The losses of the Scots have been placed at 11,000 out of 40,000 engaged, but both figures are too high. Certain it is that they lost heavily, especially among the nobles, who fought to the last around the king, and it is this that made the day so sad to Scottish memories. The English losses were perhaps 1,000. The best known reference in literature is Scott's description in *Marmion*. A monument, known as the King's stone, marks the spot where James is supposed to have been killed.

Flogging. Punishment for crime. In English law, flogging was abolished by the Criminal Justice Act, 1948, except as a prison punishment, and as such it can be awarded only in the case of mutiny, incitement to mutiny, or gross personal violence to a prison officer. Birching, a former punishment for boys under 16, was also abolished by the same Act.

Flood. Submersion of land by overflow of water. After extra heavy or prolonged rainfall, or in spring and summer, when snow and ice fields melt, great quantities of surface water drain directly into rivers. At the latter period floodwater is often held up by ice barriers in the lower reaches. The banks cannot contain all the water, which, overflowing, submerges the low-lying parts of the valley. Many parts of the world have clearly marked wet and dry seasons; heavy rains during the wet season cause floods, but the same rivers during the dry season are merely dry courses containing small lakes in the deepest parts of the bed. Floods may be caused by the effects of tide and wind, *e.g.* in the Thames and Elbe.

Egypt is aptly called "the Gift of the Nile," for in that land occurs the phenomenon of extensive floods in a land of little or no rainfall. The Nile rises in great lakes, situated in a region where rain falls at all seasons, thus

ensuring a steady current of water. But tributaries like the Sobat, Blue Nile, and Atbara have their sources in regions of heavy summer rainfall, and the summer water they bring down causes floods along the lower course of the main stream. But for these waters Egypt would be a desert.

The character of the soil may also aid floods. Large areas of N. England and Scotland are composed of hard or impervious rocks, from which the water is rapidly drained into the rivers, so that the latter are quickly in flood during heavy rains and very low during dry weather. Where limestone or other pervious rocks are found, rain sinks into the ground and the rivers maintain a steady flow, even in dry weather. The Mississippi basin and the great Chinese plains often experience disastrous floods. See Deluge.

Flood, HENRY (1732-91). Irish statesman and orator. Educated at Trinity College, Dublin, and Christ Church, Oxford, and called to the English bar in 1750, he entered the Irish house of commons in 1759 as member for Kilkenny. His closely reasoned oratory and his mastery of



Henry Flood,
Irish statesman
After Comerford

parliamentary tactics made him leader of the national party, and in 1775 he was made a privy councillor and vice-treasurer of Ireland. His opposition to Henry Grattan (*q.v.*), who superseded him as party leader about 1781, on the "simple repeal" question led to their famous quarrel, Flood urging the renunciation by England of all claims to influence Irish legislation. He remained loyal, however, to George II. In 1783 Flood was returned to the British house of commons as member for Winchester. He died Dec. 2, 1791.

Floodlighting. Effect produced by illuminating the exterior of buildings by powerful concealed electric lamps provided with suitable reflectors. Floodlights were originally used in theatres for special stage effects and later in film studios. For exteriors it was realized that floodlights at night shining upon the vertical faces of buildings of architectural note or historical interest could bring out beauties of design which daylight failed to reveal.



Floodlighting. The Royal Naval College at Greenwich, designed by Inigo Jones, John Webb, and Wren, reveals new architectural beauties when floodlit

White floodlighting is the most efficient form of illumination. Coloured floodlighting, using screens in the lamps, is spectacular but is relatively more costly. In some coloured floodlights in the light issues from a gaseous discharge tube, the colour is produced without screens by the characteristic properties of the gas with which the tube is filled. Floodlighting has been used for advertising with success, particularly for illuminating poster sites. The light is turned on and off by a time-switch. Floodlighting is also used in building so that construction can proceed after dark. During the Second Great War portable floodlights were used to facilitate rescue of people buried in bombed buildings. The fire services also provide small floodlights on their engines.

Floor. Horizontal division in a building. Floors are described according to position as ground floor, first floor, etc., intermediate levels being known as mezzanine floors. In houses they are usually constructed of timber bridging joists which rest on the walls. When the walls are widely spaced steel or timber beams are used to give intermediate support. Ground floors may be of concrete resting on the ground (solid floors) or of

joists supported on low brick sleeper walls, leaving a space under the floor which must be ventilated. In multi-storey buildings, which must be fire-resisting, concrete reinforced with steel rods is the most suitable material. There are many proprietary forms of floors, some entirely of reinforced concrete (pre-cast or cast *in situ*) and others with hollow tile blocks with reinforced concrete ribs between. Wood floors are finished with boarding, sometimes covered with a thin layer of hardwood laid to a pattern and known as parquet. Concrete floors can be finished with boarding, wood blocks, tiles, marble, etc.

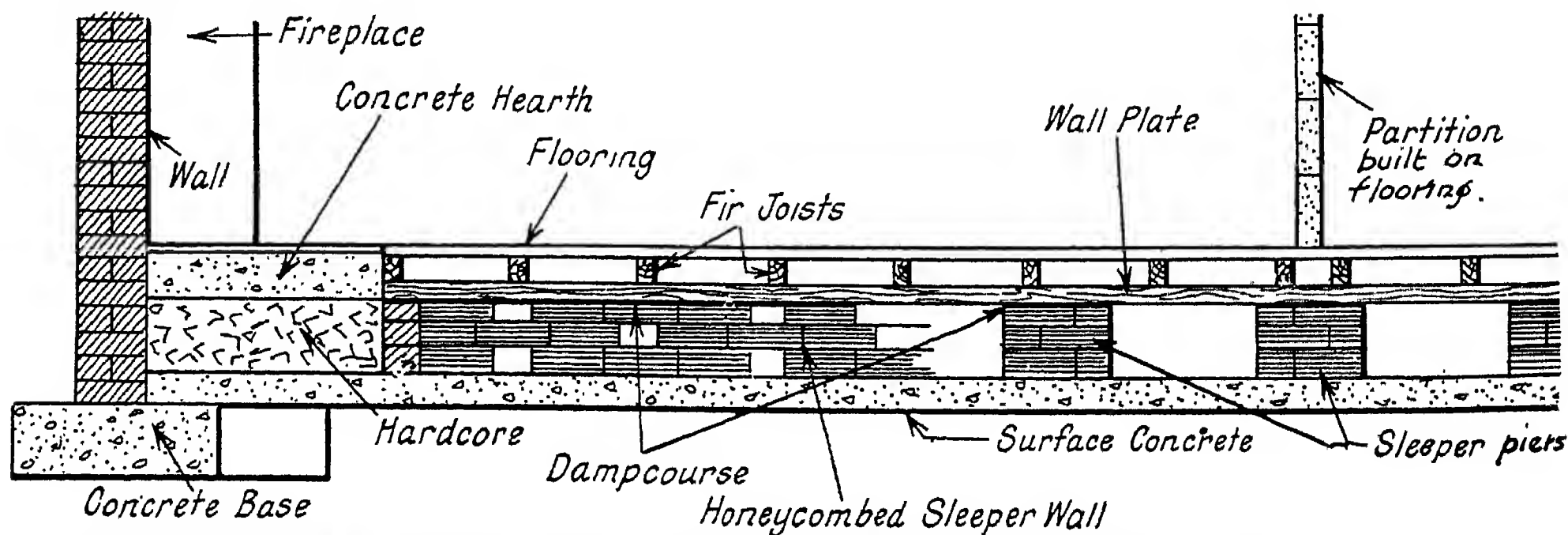
Floorcloth. Type of floor covering made by building up successive layers of oil, chalk, and pigment on a woven backing and printing the surface. Such "oilcloth" is not much used nowadays. Kamptulicon (patented by Galloway in 1844) was made of rubber mixed with naphtha, gutta percha, and mineral fillers, but its development was discontinued about 1857 when rubber became too costly owing to vulcanisation. Linoleum (patented by Walton in 1861) is made of oxidised linseed oil, ground cork, gum, pigments, etc., on a woven canvas or other backing. Its simplest form, plain

linoleum, is used as a base for printed linoleums, in which the surface is printed with patterns. Variations of plain linoleums are jaspé, moiré, granite, sheet marble, effects obtained by variations in the mixing and calendering. Inlaid linoleum (first produced 1880) is made by inlaying patterns of plain or multicoloured strips or granules on a canvas backing, the pattern going right through. Cork carpet is similar, except that coarser granules of cork are used and a smaller percentage of oxidised linseed oil, the result being a softer, more resilient surface. Felt base floor covering is made of bituminised paper felt with a printed surface.

Floors OR FLEURS CASTLE. Seat of the duke of Roxburgh. It stands on the Tweed just W. of Kelso. The Kers had long had a residence here when in 1718 Sir John Vanbrugh planned a new house for the duke of Roxburgh. In the middle of the 19th century it was largely rebuilt, being made into a magnificent building in the Tudor style. It has large gardens, and commands extensive views. A holly tree is said to stand where James II was killed in 1460.

Floquet, CHARLES THOMAS (1828-96). French statesman. Born at St. Jean-Pied-de-Port, Basses Pyrénées, Oct. 2, 1828, he became an advocate and joined the Republican party. He was active in the overthrowing of Napoleon III, and sat as deputy for the Seine in the national assembly of 1871. Suspected of dealings with the communists, he was imprisoned by Thiers' government, but returned to the chamber as one of the deputies for Paris, 1876.

President of the chamber 1885-88, he became president of the council, and formed a radical ministry on April 3, 1888. On



Floor. Sectional view of a timber framed ground floor, showing how concrete is used in the construction of the hearth; the sleeper walls and piers and the position of the damp course are also seen



Flora Day. The famous Furry Dance being performed in the main street of Helston, Cornwall, on Flora or Furry Day, May 8

July 12 General Boulanger demanded a dissolution, and his accusations of falsehood against Floquet led to their fighting a duel next day, in which both were wounded. The ministry began to lose favour after bringing in a constitutional reform bill, and resigned Feb. 14, 1889. Re-elected president of the chamber, Floquet held this post until it was shown that he had received about £11,500 from the Panama company for the use of his party. This forced his resignation, Nov., 1892, though he made a full statement of defence at the trial of those more culpably involved. He died Jan. 18, 1896.

Flora. The collective species of plants growing naturally in any district or country, *e.g.* the flora of Wales. Also used for a book describing plants, arranged according to the laws of botanical classification.

Flora. In Roman mythology, the goddess of flowers. She had a temple near the Circus Maximus, and her festival, Floralia, was held every year from April 28 to May 1.

Flora Day OR **FURRY DAY.** Holiday observed at Helston, Cornwall, on May 8, the feast of the apparition of S. Michael, patron saint of the town. Its origin was probably pre-Christian and connected with the pagan spring festival. The day was formerly given over to revelry, any person found working being made to leap the river. The Furry Dance is still performed through the streets and in and out of the houses, the dancers headed by a band. Another custom observed is the Halantow; men and boys go into the river valley collecting greenery, and then form a rowdy procession headed by a donkey, blowing mayhorns and singing through the streets a song concerning Robin Hood and Little John. Furry Day attracts crowds of

visitors. The song called The Floral Dance, composed by Katie Moss, refers to this celebration.

FLORENCE: ITS HISTORY & TREASURES

Cecil Headlam, Author of *Venetia and Northern Italy*

The city and its buildings are here described, and the history of the state that grew up around it is outlined. See Tuscany; Medici; and biographies of Savonarola, Macchiavelli, and other great Florentines; also Italy: History, Literature, Art; Guelphs and Ghibellines



Florence arms

Florence (Ital. Firenze), capital of a prov. of the same name, lies on both banks of the Arno. The river is spanned by six bridges (five rebuilt after the Second Great War), and lined on both banks by modern quays. Broad boulevards mark the line of the old walls on the right bank (Lung'arno). Across the river (Oltr'arno) the walls and gateways begun by Arnolfo di Cambio, 1285, in succession to the smaller circuit of 1173, and still earlier Roman square, remained almost intact until blown up by the Germans in 1944. Set in a valley among the foothills of the Apennines, Florence owes to the proximity of mountains and sea a variable and trying climate.

The site and development of the city were determined by a natural crossing point in the Arno, where, narrowed by the hill of San Giorgio and deepened by the tributary Mugnone, its navigable course begins soon after it turns W. towards Pisa and the Tyrrhenian Sea. Here, at a point indicated by the recently destroyed Mercato Vecchio, or old forum, later the Piazza Vittorio Emanuele, and the picturesque Ponte Vecchio, designed by Taddeo Gaddi in 1365, the Roman road to the N. probably crossed an older Etruscan road

Floréal (Fr., flowery). Eighth month in the year of the French Revolutionary calendar. In the year 1 it began on April 20. See under Calendar.

Florence (Ital. Firenze). Province of Tuscany, N. Italy. It lies S. of Bologna, and N. of Siena and Arezzo, midway between the Adriatic and the Ligurian seas. The surface is hilly, and occupies part of the basin of the Arno. The soil is fertile, olives and grapes growing in profusion. Much wine is made, and silk is manufactured. Sheep are reared on the grassy uplands. The capital is Florence: other towns of importance are Prato, Empoli, Fiesole, and Figline. Area 1,497 sq. m. Pop. (1951) 929,432.

running E. and W. Etruscan walls at Fiesole and Etruscan antiquities in the Museo Archeologico recall the original settlers.

Roman remains include a theatre at Fiesole, and in Florence, baths (Via delle Terme), and an amphitheatre (Piazza Peruzzi). The baptistery of San Giovanni (Battistero), with its superb 14th-15th cent. gates of gilded bronze by Pisano and Ghiberti, stands on the site of a temple of Mars. The Tuscan-Romanesque churches of S. Apostoli and San Miniato mark the rise of Florence in the 11th century. They inspired the Renaissance churches of Brunelleschi, San Spirito, and San Lorenzo. The latter, near the palace of the Medici, has always been closely connected with that family. Here, besides the domed mausoleum added by Cosimo I, is the new sacristy built by Michelangelo for Pope Clement VII (1524), where that artist's wonderful statues of Day and Night, Evening and Dawn, guard the monuments of Lorenzo and Giuliano de' Medici. Here, too, is the Biblioteca Laurenziana, the priceless library of books and manuscripts collected by Cosimo and Lorenzo il Magnifico, and housed by Michelangelo.

In the 13th century Florence became a veritable forest of towers, built by turbulent nobles, as in the Borgo Santissimi Apostoli. She was now to be adorned with vast Gothic churches and splendid public buildings, such as the palace of the Podestà, the Bargello,

which enshrines the National Museum, and the Palazzo Vecchio, with its soaring tower and projecting battlements, designed (1298) by Arnolfo di Cambio, for the safe housing of the Priori. The adjoining open-vaulted Loggia dei Priori (or Lanzi) was begun in 1376. The captain of the people resided at the Badia, a Benedictine Abbey founded by the mother of Count Hugo of Tuscany, whose graceful campanile dates from 1300.

The first great period of Florentine art coincided with the establishment of democratic government. Niccolò and Giovanni Pisano in sculpture, and in painting, Cimabue, his pupil Giotto, and Andrea Orcagna led the way in the great era of artistic freedom and grace, inspired by that same passionate interest in life as Dante and Boccaccio exhibit in verse and prose. In architecture, Arnolfo di Cambio, besides the city walls and the Palazzo Vecchio, built Santa Croce for the Franciscans (1297). Here, as in the building of the Duomo, he was succeeded by Giotto and Francesco Talenti. In 1420 the great dome of this, the fourth largest church in Europe, was begun by Filippo Brunelleschi. Giotto's lovely campanile, with its four storeys of marble, was begun, 1334, and completed by Andrea Pisano and Francesco Talenti, 1387.

Church Architecture

S. of the Piazza del Duomo is the graceful little Loggia del Bigallo (1352), resembling in style Andrea Orcagna's more gorgeous tabernacle in that splendid sanctuary of the guilds, Or San Michele, begun in 1337. The Dominican church of Santa Maria Novella was begun in 1278. The façade is by Leo Battista Alberti, the lovely arcade by Brunelleschi, and the exquisite Spanish chapel by Fra Jacopo Talenti. The much modernised church and convent of San Marco fascinates both by the art of Fra Angelico and Fra Bartolommeo, and its memories of Savonarola. The great 14th century church of the Santissima Annunziata has also been much altered, but contains some of the finest work of Andrea del Sarto.

The story of Florentine art, as it developed through Masolino and Masaccio, Fra Angelico, Lippi, Andrea del Castagno, to Andrea Verrocchio, Sandro Botticelli, Domenico Ghirlandaio and Leonardo da Vinci, Michelangelo Buonarroti and Raphael, and a host of other great artists, including Luca and Andrea della Robbia, Vasari, Benvenuto Cellini, and Gian di Bologna, can be followed in these and other churches, as well as in the great

galleries, the Academy of Fine Art, the Uffizi Palace, government offices constructed by Vasari for the grand duke Cosimo I, and the Pitti Palace. The latter, like the Palazzo Strozzi and Palazzo Rucellai (Alberti), is a typical Renaissance palace, and was begun by Luca Pitti, the opponent of Lorenzo the Magnificent, and afterwards occupied by his successors.

HISTORY. Florence was founded by the Etruscans. They had first settled at Fiesole, about 700 B.C., upon a rocky height to the N., commanding the way across the neighbouring Apennines to the Adriatic coast. Tempted down to the banks of the Arno by the commercial advantages of plain and river, they were presently supplanted by the Romans, whose quadrangular castrum is described as *municipium splendidissimum* in the time of Sulla.

Saved from the Goths by the legions of Stilicho and the prayers of Zenobius, a saintly bishop whose miracles often figure in Florentine art, the inhabitants fled later for refuge to Fiesole before the Lombards, but prosperity returned to their city under Charlemagne. The great power of the margraves of Tuscany delayed the rise of the Tuscan towns; but under the protection of Matilda, countess of Tuscany, and after her death in 1115, while Papacy and Empire were fighting for her heritage, Florence developed into a powerful, independent burgher city. Members of the chief families who had administered Florence in Matilda's name, now became consuls of the commune, annually elected, two for each *sestiere*, and were advised by a senate of 100 drawn mainly from the trade guilds. They led the burgher forces in their struggle against imperial vicars and feudal nobles. For the surrounding country, called the *contado*, bristled with castles, whence barons, of Teuton origin and adherents of the Empire, harried the pack-trains of the citizens.

Growth of the Commune

As the commune made herself mistress first of Fiesole (1125), and then of the *contado*, she compelled these barons to take up their residence within the city. There they joined with other citizen-nobles of aristocratic tendencies and fortified themselves in lofty towers. Against these societies of the towers, and the domination of an alien power, the burghers of the commune, a commercial democracy of Latin descent, grouped into trade guilds, strove unceasingly. This is the form which the feud betwixt

Guelph and Ghibelline took in Florence.

Her interest as a growing banking and carrying community on the trade-route from Rome naturally inclined Florence to the side of the Church, while involving her in commercial rivalry with Pisa, which barred her free communication with the sea; with Siena, the leading city between her and Rome; Pistoia, and other Ghibelline cities. For centuries she waged deadly trade wars with these rivals until she finally reduced them to subjection. The murder of one of the Buondelmonti, leaders of the democratic party, accentuated the bitterness of party faction.

Beneath the mask of family feuds, the Florentine commune was always striving, through successive changes in the constitution, and in spite of frequent reactions, towards the completest form of democratic liberty known to the Middle Ages. The lower class of artisans and the populace had as yet no share in the government (*Signoria*), except as a parliament (*Arengo*), assembled in the city square to shout a decision upon momentous matters. But the struggle between people and patrician magnates by this time had already begun.

Democratic Developments

The Guelph magnates remained in power, leading the Carroccio and red and white banner (*gonfalone*) of the commune to victory against their neighbours until, in 1249, the Uberti, aided by the Emperor's German troops, thrust them into exile. On the death of Frederick II in 1250, however, the people rose and established the first democratic constitution. Twelve elders (*anziani*) and thirty-six corporals (*caporali*) were appointed as a central government. A popular militia was formed, and a foreign Guelph noble, assisted by a special and a general council, was annually elected as "captain of the people" to champion their cause against the Podestà (1250).

This officer, also an annually elected foreign noble, had replaced the consuls about 1200, and became the representative of the Ghibelline aristocrats and of imperial claims. He, too, presided over two councils; so that there were now two political organizations, that of the nobles and that of the people, within the Republic. Ten years later the exiled Ghibellines, rallying at Siena, and reinforced by the German mercenaries of Manfred of Sicily, defeated the Guelphs at Montaperti.

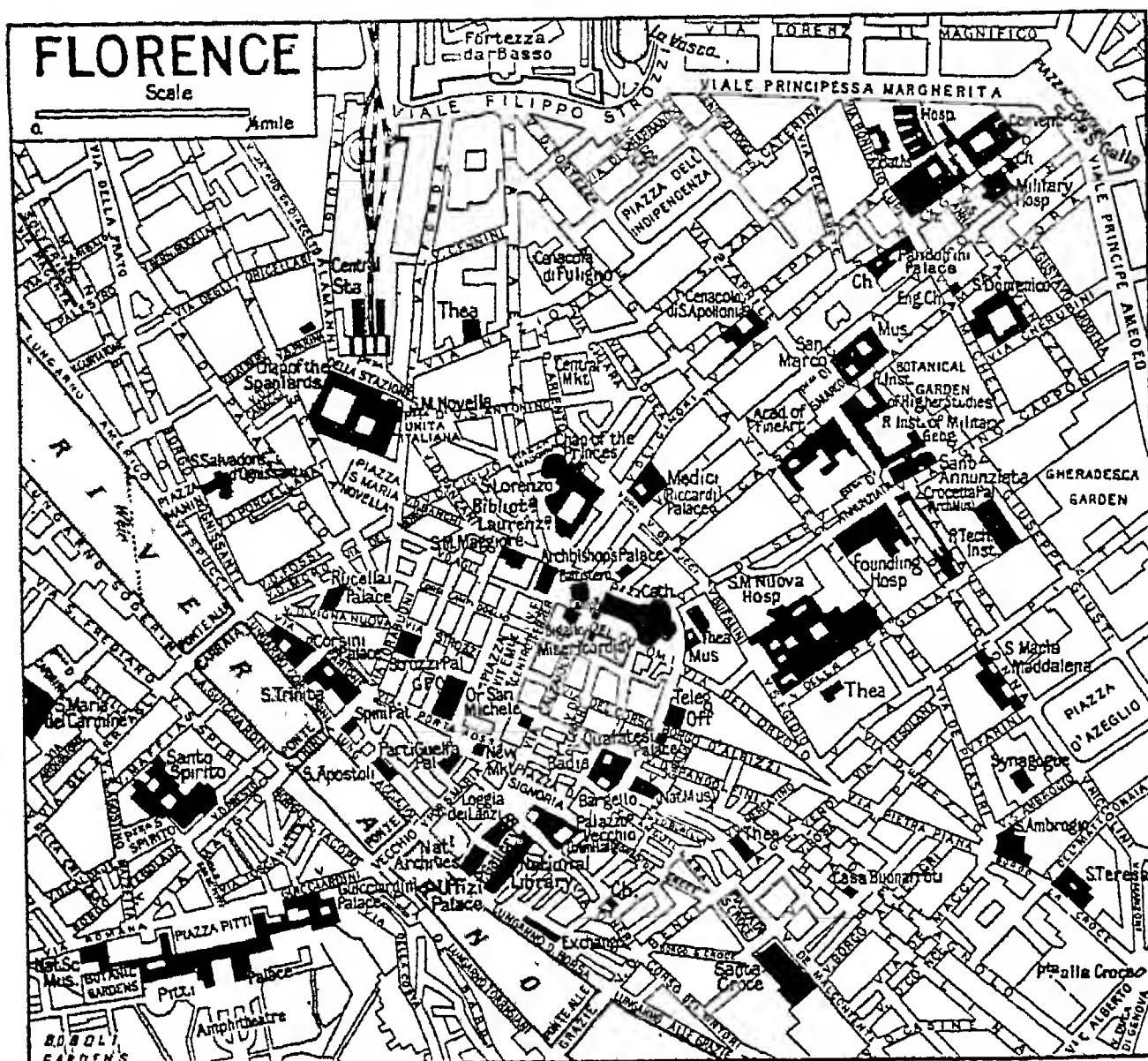
The coming of Charles of Anjou, after the battle of Benevento, put an end to the domination of Ghibelline and German (1266). The



1. Palazzo Vecchio, 1298-1314, used as the town hall since 1871. 2. View from the church of S. Spirito, showing Giotto's campanile and dome of the cathedral. 3. Church of S. Croce, begun in 1294. The new façade built 1857-63. 4. Pitti Palace, begun in 1440, containing the famous picture gallery. 5. The Baptistery, c.1200. 6. Palazzo

Vecchio, the Renaissance courtyard built in the 16th century. 7. Cathedral of S. Maria del Fiore, crowned with Brunelleschi's dome, 1420-34. 8. Portico of the Uffizi Palace, 1560-74, containing Art Galleries and National Library. 9. Ponte Vecchio, across the Arno, built in 1345, and spared by the retreating Germans in 1944

FLORENCE: ITALIAN CITY FAMOUS IN LITERATURE AND ART



Florence. Plan of the centre of the city, showing the principal buildings and bridges; most of the latter were demolished by the German army in 1944

Florentine Guelphs acknowledged Charles's suzerainty as king of Naples and Sicily. An organization (*Parte Guelfa*) was formed to persecute Ghibellines, and a new constitution (*Secondo Popolo*) similar to the first, but of a more democratic character, was set up.

In 1293 the famous ordinances of justice were enacted, intended to restrain the reviving power of the nobles, and barring them altogether from the *Signoria*. In 1300 a new officer of justice, the *Gonfaloniere*, or standard-bearer of the people, was added. Under this republic of merchants (*Villari*) the great "Trecento" era of art and literature blossomed forth.

Commercial Prosperity

The commercial prosperity of Florence was now great. Her merchants dealt in the wool of Latium and Lombardy, the oil and wine of Tuscany, the spices, silks, and dyes of the East; the craftsmen of the Calimala guild dressed and dyed foreign cloth into artistic fabrics, which were prized throughout Europe; while her bankers with their standard golden "florin," first coined 1252, provided the necessary medium of exchange, and extended her financial influence far and wide.

Head of the Guelphic League, Florence was now the chief power in Tuscany. At Campaldino (1289) she had shattered the remaining forces of the Tuscan Ghibellines. The Guelphs, however, soon split into factions, Neri

and Bianchi, headed by the Donati and Cerchi families. Dante, an adherent of the Bianchi, was banished when Charles of Valois, in alliance with the Neri, sacked the city, 1301. Nevertheless, the merchant republic succeeded in forming what was practically a confederation of all Italy.

The victorious Neri soon split into factions. Florence then fell a prey to the exactions of the Angevin sovereigns of Naples, and the tyranny of a French soldier of fortune, Walter de Brienne, duke of Athens. After his fall the people rose and annihilated the magnates, 1343.

Dawn of the Renaissance

The struggle for political power was henceforth between the rich burgher aristocracy (*Ottimati*) of the greater guilds and *popolo minuto*, the rest of the unfranchised guilds and people, typified by a rising of the latter (*Ciampi*), led by Michele di Lando, a patriotic wool-comber. The dawn of the Renaissance found Florence full of artists and scholars patronised by the *Ottimati*. Fierce wars were waged with Milan and other cities by mercenaries, such as those led by the English captain Hawkwood, and the dominion of Florence was extended over Pisa (1406), Arezzo, Cortona, and Leghorn. But the divisions of the Republic finally placed it at the mercy of Cosimo, son of Giovanni de' Medici, the richest banker in Italy. Returning from exile, he took his

place as Despot of Florence (1443). The outward forms of the old constitution were retained, while Cosimo controlled the elections and broke the power of the *Ottimati*. At home he patronised artists (Brunelleschi, Michelozzo, Donatello, Fra Lippo Lippi, Fra Angelico), and encouraged the Neo-Platonism of the Renaissance by his Platonic Academy. He was succeeded by his son Piero (1464) and his grandson Lorenzo il Magnifico.

Lorenzo and Savonarola

Lorenzo maintained the balance of power among the five Italian states, and was treated as an equal by foreign potentates. At home, Florence, beautified by artists sprung from the people, became the brilliant world-centre of the revival of Greek culture. But before Lorenzo's death Fra Girolamo Savonarola, denouncing the tyranny and corruption of state and church, had prepared the way for Republican reaction. Roused by Piero II's surrender to the French invaders, the people expelled the three sons of Lorenzo. Charles VIII entered the city, Nov. 17, 1494, and took the Republic under his protection. A brief period of political and spiritual reform, inspired by the prophetic fervour of Savonarola, was followed by the excommunication and burning of the monk (May 23, 1498).

The *Gonfaloniere*, Piero Soderini (1502), with Niccolò Macchiavelli for secretary of state, maintained the Republic until the Medici were restored by the Spanish invaders (1512). Republicanism made one last glorious effort under Niccolò Capponi (1527). But the emperor Charles V, in alliance with Pope Clement VII, who had ruled Florence as Cardinal Giulio de' Medici, reduced the town after a siege of eleven months.

Charles appointed Alessandro, illegitimate son of Lorenzo, son of Piero II, duke of Florence. Alessandro suppressed the ancient *Signoria* for ever. He was murdered in the Palazzo Medici by his kinsman, Lorenzino, and was succeeded by Cosimo I de' Medici, "the Great" (1537). Allying himself with Spain and the Papacy, and making himself master of the surrounding country, while he patronised the artists of the late Renaissance, Cosimo founded a long line of grand dukes of Tuscany (1569).

Florence remained the capital of Tuscany when, in 1737, the Medici line having become extinct, the duchy was annexed by the emperor and became an appanage of the House of Austria. After the Napoleonic interludes of the republic and kingdom of

Etruria, 1801-07, Tuscany joined the growing kingdom of Italy by a plebiscite in 1860, and Florence became the first capital of the united kingdom of Italy (1865-71).

Florence was declared an open city on July 1, 1944, during the fighting in the Second Great War, and by Aug. 5 the suburbs on the S. bank of the Arno were in Allied hands. The Germans had destroyed all the bridges except the Ponte Vecchio, and did not evacuate the city until Aug. 11. They shelled it on Aug. 20, causing many casualties among civilians returning from church. British troops entered next day, when fighting between the fascists and Italian patriots had ceased. The Germans had removed works of art from the city galleries, some to villas surrounding the city, where they were found by the advancing allies, others to salt mines in Tirol, where they were discovered after the German surrender. All were accounted for and returned to Florence by July, 1945. Rebuilding of the destroyed bridges followed immediately on the end of the war. Pop. (1951) 390,832. Consult Standard histories, H. E. Napier, 6 vols., 1846-47; T. A. Trollope, 4 vols., 1865; G. Capponi, 2 vols., 1875 (in Italian); F. T. Perrens, 9 vols., Eng. trans. 1892. Consult also A Wanderer in Florence, E. V. Lucas, 1912.

Florence of Worcester (d. 1118). English chronicler. A monk at Worcester, he lived in the time of William II and Henry I and died in July, 1118. His chronicle of English history begins with the Creation, and is filled with stories and legends from earlier writings, but is valuable for the period covered by the author's life. The work was continued to 1141 by John of Worcester. An Eng. trans. was edited by B. Thorpe, 1848.

Flores. Island of the Azores, in the Atlantic Ocean. It is the most westerly of the group. The surface is mountainous, and sheep are reared on the grassy slopes. The soil is fertile, and fruit and vegetables are cultivated. The chief town is Santa Cruz. Area 60 sq. m. Off Flores, in 1591, took place the naval action between Sir Richard Grenville in the *Revenge* and several Spanish vessels, described in Tennyson's poem *The Ballad of the Revenge*.

Flores. Island of Indonesia, in the Sunda group. A dependency of Timor, it lies S. of Celebes, from which it is separated by the Flores Sea, midway be-

tween Java and Timor. Oblong in shape, it is 230 m. from W. to E., with an average breadth from N. to S. of 28 m., and an area of 5,860 sq. m. The chief products include sandalwood, cotton, edible birds' nests, dyewoods, tortoiseshell, and beeswax, while rubber culture is making progress. Pop. approx. 250,000.

Flores. Department of S.W. Uruguay. It is bounded on the N. by Durazno and on the S. by San José. It is hilly, with good pasturage; agriculture and stock-raising are the principal industries. The capital is Trinidad, connected by branch line to Durazno on the rly. running N. from Montevideo. Area 1,744 sq. m. Pop. 36,125.

Flores Sea. Part of the S. Pacific Ocean. It lies between the island of Flores on the S. and Celebes on the N., E. of the Sunda Sea and W. of the Banda Sea. There are many islands and coral atolls in this sea.

Floret (Fr. *fleurette*, little flower). Term used to denote a small flower, one of a number closely packed together, presenting in the aggregate the appearance of one large flower. This especially applies to the large family Compositae. In the common daisy (*Bellis perennis*) what is popularly called the flower is a closely packed head (*capitulum*) of about 250 florets, of which four-fifths are short, yellow-coloured tubes, constituting the disk. Around the disk is an outer series in which the tube has been split into a much larger white strap. These ray-florets contain no stamens; their principal purpose is to make the flower-head conspicuous and attract insects to effect cross-pollination. Groundsel (*Senecio vulgaris*) has all its florets without rays, while in dandelion (*Taraxacum officinale*) they are all rayed.

Florey, Sir Howard Walter (b. 1898). Australian pathologist. Born Sept. 24, 1898, he was educated at Adelaide university, and Magdalen College, Oxford. Professor of pathology at Sheffield, 1931-35, he later carried out experiments and research on penicillin at the Oxford school of pathology. Among his team of collaborators was E. B. Chain (*q.v.*). Although the initial discovery of penicillin was due to Sir Alexander Fleming (*q.v.*), Florey's work from 1938 led to the separation of the drug later used in medical treatment from the original penicillin which contained poisonous substances. He was knighted in 1944; in 1945 he

shared the Nobel prize for medicine with Fleming and Chain; in 1946 he received the Albert gold medal from the Royal Society of Arts. See Penicillin.

Florian, Jean Pierre Claris de (1755-94). French author and academician. Born March 6, 1755, he obtained an appointment in the household of the duke of Penthièvre, and afterwards held a commission in a cavalry regiment. He was imprisoned when the Revolution broke out, and died Sept. 13, 1794, soon after his release. Author of several comedies, romances, and pastorals, he was elected to the French Academy in 1788. He is remembered chiefly for his Fables, 1792.

Florianopolis. Seaport and city of Brazil; capital of the state of Santa Catharina. Its old name was Desterro. It stands on the W. coast of Santa Catharina Island, 260 m. S.W. of Santos, and is connected to the mainland by a steel bridge 935 yds. long. The fine harbour is guarded by forts. There are a cathedral, government palace, arsenal, hospital, high school, etc. Dairy produce, maize, rice, and tobacco are exported. Pop. (est.) 48,000.

Florida. State in the extreme S.E. of the U.S.A. Bounded N. by Alabama and Georgia, its area is 58,560 sq. m., including 4,298 sq. m. of inland water, almost exactly the size of England and Wales. It is designated the Peninsular State from its peculiar elongation, or the Everglades State because of 4,472 sq. m. of overgrown marshland in the extreme S. Its tidal coastline, the longest of any state, measures 3,751 m., including the Ten Thousand Islands off the W. coast.

Of limestone formation, Florida has 30,000 lakes, including Okeechobee, 717 sq. m., in the Everglades; many navigable rivers, including the St. John's, Suwanee, and Apalachicola, and innumerable subterranean streams; but no mountains and little elevation. The state passes through three climatic zones, from warm temperate in the N. through semi-tropical to sub-tropical in the extreme S., where a daily average of over 6 hours' sunshine and a mean temp. of 69° F. allows four distinct growing seasons. This portion, which benefits from the Gulf Stream and trade winds, does occasionally suffer from West Indian hurricanes. Frost is unknown at Key West, 100 m. off the mainland. Florida has 3,000 varieties of indigenous flowering

plants, half the tree species found N. of Mexico, and hundreds of species and sub-species of bird, butterfly, and fish.

Famous for oranges and other citrous fruits, Florida also grows pineapples, bananas, avocados, olives, figs, coconuts, peanuts, cotton, tobacco, maize, oats, and sugar cane. It yields 70 p.c. of the nation's phosphate, also fuller's earth, limestone, lime, cement, clay, and forest products. Sponge fishing is profitable. Cattle raising and tung-oil production are comparatively new industries. The pop. increased by 29 p.c. between 1930 and 1940, because of tourists becoming residents, the influx of new industries, and the establishment of military and naval installations, airfields, seaplane and submarine bases. A further increase in its pop. to 2,771,305 in 1950 gave it eight (instead of six) representatives, as well as two senators, in congress. Tallahassee is the capital. Educational institutions include the University of Florida at Gainesville, a state college for women. Florida agricultural and mechanical University; and the Universities of Miami and Tampa, both of which are privately endowed. St. Augustine, founded in 1565, is the oldest permanent white settlement in the U.S.A. Florida has 7,500 m. of rly., 45,000 m. of paved roads, and a canal system (not yet completed) which, with natural waterways, crosses the Everglades from the Atlantic to the Gulf. The longest overseas thoroughfare in the world, 131 m., connects the mainland with Key West, the southernmost city of the U.S.A.

Florida derived its name from the day in 1513 on which it was discovered by Ponce de Léon—Easter Day (Sp. *Pascua florida*), and was by turns in the possession of Spain, France, and the U.K. The U.S.A. acquired it from Spain 1819 (ratified 1821). It was made a territory 1822, admitted to the union as a state 1845. Consult *The Story of Florida*, W. T. Cash, 1938.

Florida. Central dept. of Uruguay, bounded N. by Durazno and S. by Canelones. The surface consists of undulating grassy tracts, watered by the Yi river, upon which are reared vast herds of cattle. Area, 4,673 sq. m. Pop. 106,495. The capital is Florida, the centre of a trade in grain, 70 m. by rly. N. of Montevideo.

Florida Bay. Arm of the Gulf of Mexico. It separates Florida state, U.S.A., from Florida Keys.

Florida Keys. Curved chain of coral and limestone reefs off the S. coast of Florida, U.S.A. Extending S.W. for 175 m. from Miami, they include Key Largo, 30 m. long, and Key West, 4 m. by 2 m. only, but containing the southernmost city of the U.S.A. They are connected by highway with the mainland. Sponge fishing and catering for tourists are the occupations. See Key West.

Florida Straits OR CHANNEL. Coastal waters off Florida, U.S.A., alternatively known as the New Bahama Channel. They separate the S.E. extremity of Florida and the Florida Keys from Cuba and the Bahama Islands. The channel is some 300 m. long, has a mean breadth of 80 m., and a greatest depth of 6,000 ft. It is traversed by the Gulf Stream.

Florideae OR RHODOPHYCEAE. Class of Algae or seaweeds. In them the chlorophyll, or green colouring matter, is masked by a red pigment (phyco-erythrin). They have no true roots, but are attached to their supports by suckers, the absorbent function of roots being carried on by the surface cells of the entire plant.

Florin. Name of several gold and silver coins of various European currencies. A gold coin struck at Florence in 1252 bore, obverse, the figure of S. John Baptist, reverse, the Florentine lily, whence came the name florin (Ital. *florino*, little flower). Similar pieces appeared in various parts of Italy. Gold florins were also minted by Charles I of Anjou, c. 1335, and by John of Luxemburg, c. 1340. The English gold florin, of approximate value six shillings, issued by Edward III in 1343, was withdrawn in 1344.

The British silver florin, value two shillings, weighed 174.55 grains. It was issued in 1849, intended as



Florin. Gold coin of Edward III; top, florin minted in 1849

Actual diameter of Edward III florin, 1 1/4 ins.; of George VI florin, 1 1/2 ins.

the first step in providing a decimal currency. A bill to bring this about was lost, but the florin continued to be minted. It was at first dubbed the "graceless florin," as the customary D.G. (Dei Gratia) did not appear on the issues between 1849-1852. The life of a florin in circulation is estimated at about 45 years.

Florina. A town of Greece, in Macedonia, formerly in Turkey-in-Europe. It is about 15 m. S. of Monastir (Bitolj), and was in the tract of territory acquired by Greece as a result of the Balkan wars, 1912-13. It came into prominence during the First Great War. Captured by the French, in April, 1916, it was retaken by the Bulgarians, Aug. 20, and then by Franco-Russian troops, Sept. 18. (See Salonica, Expedition to; Serbia, Conquest of.)

The town was overrun by the Germans in the early days of April, 1941 (see Greece, Campaign of 1941), and remained in Axis occupation until Nov., 1944. Pop. (1951) 12,270. Florina gives its name to a dept. with pop. (1951) 69,391.

Florio, JOHN (c. 1553-1625). Author and translator. Born in London, he was the son of an



John Florio, translator of Montaigne

Italian Protestant who became minister to an English congregation of Italians who shared his religious opinions. John was educated at Magdalen College, Oxford, became

a teacher of French and Italian in the university, and held various offices at court, including that of tutor to Prince Henry, son of James I. In 1598 appeared his Italian-English dictionary, *A World of Words*, and in 1603 his famous translation of Montaigne's *Essays*, on which his reputation rests. Florio died of the plague at Fulham. Ben Jonson was one of his friends.

Florizel. Character in Shakespeare's *The Winter's Tale*. He is the son of Polixenes, king of Bohemia, and falls in love with Perdita, who, brought up by a Bohemian shepherd, is the lost daughter of Leontes, king of Sicily. The name was applied to the Prince Regent (George IV) on his amour with the actress "Perdita" (Mary) Robinson, whom he first saw playing in *The Winter's Tale*. Prince Florizel is the chief character in Stevenson's *New Arabian Nights*.

Florodora. Musical comedy written by Owen Hall (James Davis) and composed by Leslie Stuart. It was produced Nov. 11, 1899, at the Lyric Theatre, London, where it ran for 455 continuous performances. Its most popular feature was the sextet, Tell me, pretty maiden.

Floscularia, OR FLOWER ANIMALCULE. Group of rotifers, common in most ponds. The body is supported on a slender stalk contained in a gelatinous tube, and the wheel-disk is provided with long, bristle-like processes which serve to entangle the minute particles on which the animal feeds. It is just visible to the naked eye.

Flotation. Method of mineral dressing, used in concentrating the valuable portion of ores or in removing unwanted constituents. It makes use of the fact that mineral particles may, depending on their type of surface, be made to stick either to water in which they are suspended or to air bubbles formed in the water. A pulp may be agitated so that a froth is formed, which rises to the surface, carrying certain mineral particles up with it and leaving others in the pulp. Sulphides are particularly amenable to flotation.

The physical and chemical theory behind flotation is complicated. Most, possibly all, minerals can be made to adhere either to water or to air; organic and inorganic chemicals are employed to attain the right conditions. Chemicals which cause particles to stick to air bubbles are known as collectors; organic acids or their alkali salts, such as soaps or xanthates, oleic or palmitic acids, are examples. Typical controllers are alkali hydroxides, carbonates, and silicates, which act as "depressants," keeping certain particles in the pulp, while "activators," such as copper sulphate, alter the surfaces of minerals to help them respond to the collector.

Preparation of the ore by crushing, grinding, preliminary concentration by gravity methods, etc., is needed before an ore may be floated. The machines used differ in design. Usually the pulp is stirred mechanically by a paddle, while air is introduced down the shaft or the air is pumped through the flotation cell in such a way that it causes the necessary agitation. The froth flows over into a launder and forms the concentrate, while the pulp is drained off as tailings. Ores of most base metals and of gold may be

concentrated by the method, while coals may be purified. See Ore Dressing.

Flotilla (Span., small fleet). Tactical unit of a fleet consisting of a number of small naval vessels, such as destroyers, submarines, motor torpedo-boats, and mine-sweepers, grouped under a commodore or a captain and intended to operate as a single unit. The strength of a destroyer flotilla varies according to operational demands, but never exceeds 20 ships, exclusive of the flotilla leader, and is divided into two or more divisions. Although organized in flotillas, submarines usually work independently; during the Second Great War, however, submarine flotillas, often referred to as U-boat packs, were sent by the Germans against Allied shipping in the N. Atlantic.

Flotilla Leader. Name formerly given to the large destroyer accommodating the officer in command of a destroyer flotilla. The term flotilla became obsolete after the Second Great War when destroyers were organized in squadrons. Flotilla leaders of the Second Great War displaced 1,870 tons on a length of 350 ft. and a beam of 36 ft., and had a speed of 36.5 knots. Their armament consisted of six 4.7-in. guns, 10 anti-aircraft guns, and four 21-in. torpedo tubes.

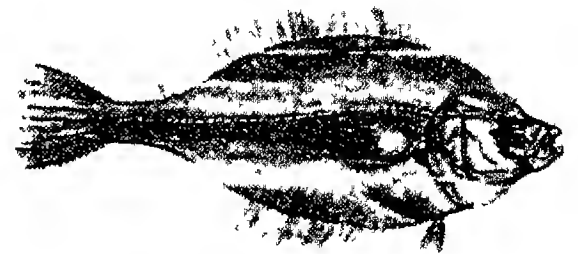
Flotow, FRIEDRICH, BARON VON (1812-83). German composer. Of a noble family of Mecklenburg-Schwerin, he was born April 27, 1812, and studied music in Paris. Of his 18 operas the earliest, *Le Naufrage de la Méduse*, brought him a reputation there in 1839. *Stradella*, 1844, had great success in Germany but failed in England. *Martha*, first performed at Vienna 1847 and London 1849, is reckoned his finest work. The only other opera to attain popularity was *L'Ombre*, 1870. Flotow was intendant of the Court theatre at Schwerin 1856-63, and in 1864 was elected to the Institut de France. He died at Darmstadt Jan. 24, 1883.

Flotsam and Jetsam (low Lat. *flottare*, to float; Lat. *jactare*, to cast). English legal term. Flotsam is goods found floating on the sea, and jetsam means goods jettisoned, cast overboard in a storm, or washed on shore after a wreck. They become crown property unless claimed by the rightful owners.

This name was adopted in 1926 by a pair of music hall and radio entertainers; Flotsam being

Bentley Collingwood Hilliam, who played the piano and wrote all their songs, and Jetsam, Malcolm McEachern (d. 1945), Australian bass singer.

Flounder (*Platichthys flesus*). Small species of flatfish, common in the sea and the lower reaches of



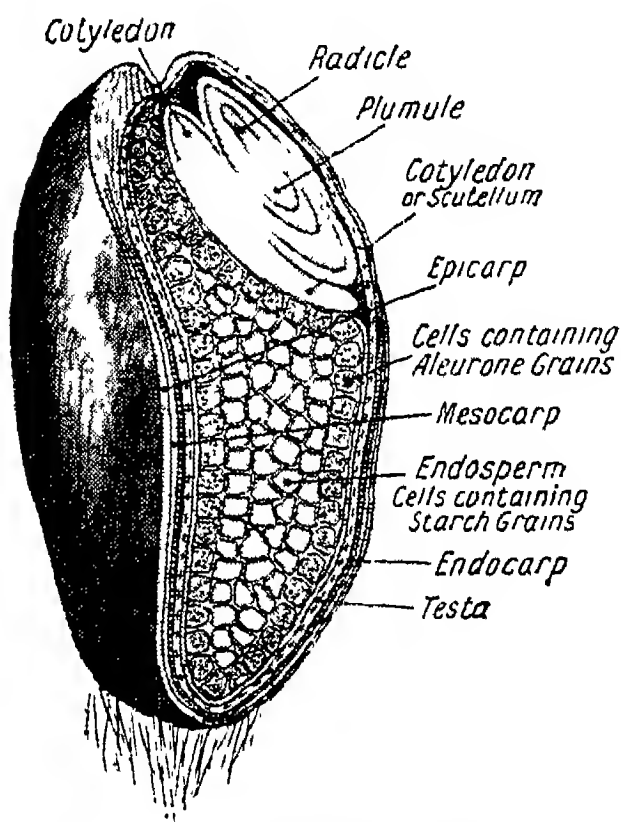
Flounder, a small flatfish found round the coasts of the British Isles

rivers. It belongs to the same group as the plaice, but is smaller, seldom 12 ins. long. It has dark mottlings, and lacks the orange-coloured spots of the larger fish. The flounder produces from one to two million eggs. Its flesh is delicate, but its small size makes it unimportant as a food fish.

Flour. The finely ground endosperm of cereal grains, particularly wheat, which may also contain fractions of the protective skins and embryo (germ), according to the method of milling and degree of extraction obtained. When a definite proportion of bran layers is milled into wheaten flour, the product is wheatmeal, whereas wholemeal is ground from whole grain. Rye is also a bread grain, and to a lesser extent barley, oats, rice, and maize; a product from the latter cereal is known as cornflour. Flour is also obtained from farinaceous grasses, fruits, nuts, pulses, roots, and tubers; e.g. bananas, soya beans, potatoes, arrowroot, buckwheat, millet, cassava, manioc, and sago palm pith. Malted flour is milled from malted grain.

The term is also used to denote other finely ground products of commerce; two mineral supplements used in animal feeds are limestone flour and steamed bone flour. A further product is wood flour, obtained from sawdust and used in making plastics and in other industries.

The wheat grain, most important of the cereals used for flour in the W. hemisphere, is a seed, comprising pericarp and seed proper. The pericarp has three skin layers, whilst the seed is further protected by three inner coats, all of which comprise the bran separated in milling. Apart from its coats the seed contains the embryo or germ, situated dorsally at one end



Flour. Longitudinal section of a grain of wheat

of the grain and separated by its scutellar tissue from the endosperm, the main constituent. The first of the inner seeds coatings is the testa or colour-bearing layer, whilst the innermost layer is the aleurone, rich in mineral constituents and nutritive factors.

Grain components vary in proportion according to wheat type, but average figures are pericarp 4 p.c.; testa and hyaline layer 2.5 p.c.; aleurone layer 6-7 p.c.; germ 2.5 p.c.; endosperm 85 p.c. Typical average composition of whole wheat grain and its components is as follows, the four

sets of figures relating to (1) whole grain, (2) endosperm, (3) bran, and (4) germ.

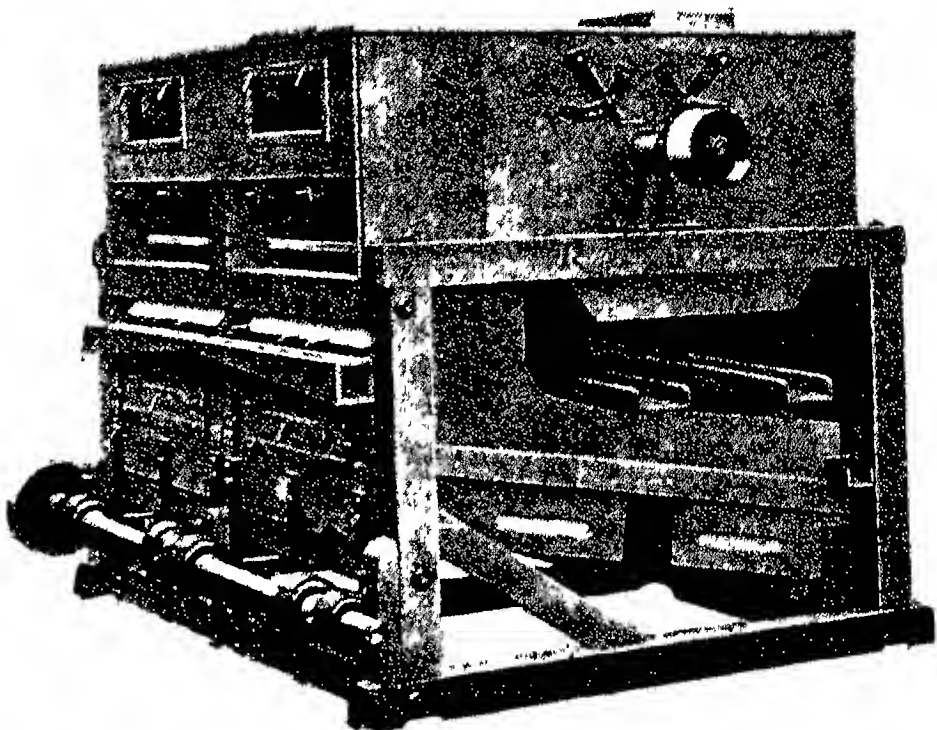
	(1)	(2)	(3)	(4)
Moisture	12.2	13.8	12.5	13.5
Oil	1.8	1.2	4.7	10.8
Protein	13.2	12.0	15.0	25.9
Fibre	2.1	0.2	7.9	1.9
Ash	1.7	0.55	4.65	4.1

The principal proteins are glutenin and gliadin, which together with water form gluten, the elastic substance in the flour which traps the aerating gas generated in the bread dough and thereby forms the cell-like structure and framework of the loaf, holding together the starch and other components.

Dividing white flour into grades according to colour and quality is normal practice. When only one grade is milled it is known as straight run flour. White flour is usually milled at 70-72 p.c. extraction, but flours up to 80 p.c. extraction can be milled which are near-white in colour and possess similar baking characteristics to those of white flour but a higher

proportion of valuable grain nutrients. Flour milled at still higher extractions assumes the character of wheatmeal.

Nutritional items occurring in wheat are iron and calcium, although the availability of the latter decreases with higher extractions on account of the phytic acid present. Also there are the Vitamins B₁, riboflavin, and nicotinic acid. The scutellum fraction of the germ is the richest source

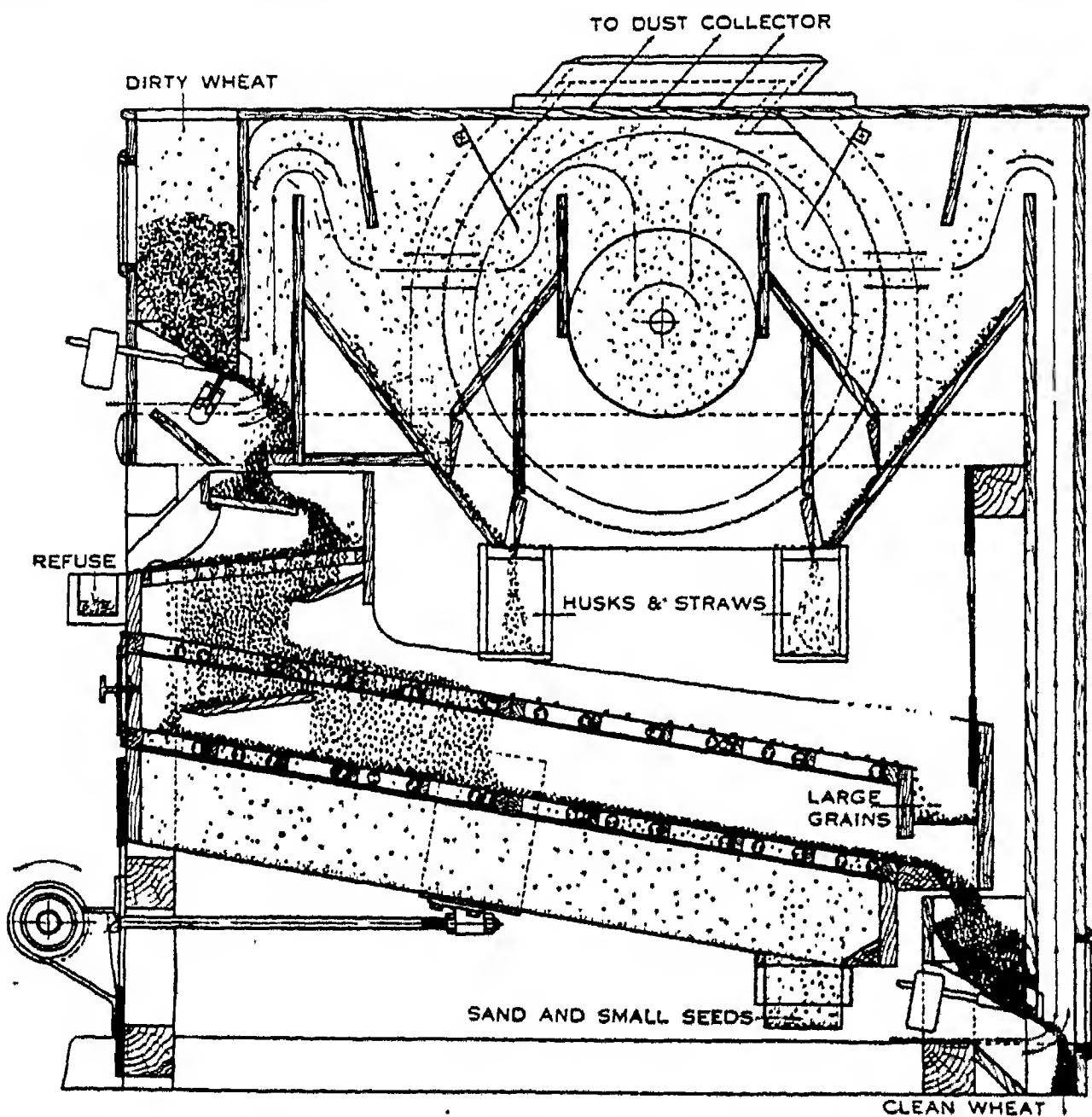


Flour Mill. Separator for removing impurities such as straw, dust, etc., from wheat and other grain before milling
Courtesy of Thos. Robinson & Son, Ltd., Rochdale

of Vitamin B₁. Semolina is a flour mill product, used in making macaroni and vermicelli. Industrially, granular flour is used in the preparation of powder alcohol. The average gross imports of wheat and flour into the U.K. for the five years up to 1938-39 were 5,148,855 tons and 409,000 tons respectively. At the end of the Second Great War the average weekly consumption of flour in the country was about 100,000 tons, requiring 112,000 tons of wheat. The wartime loaf included roughly 75 p.c. imported wheat and flour—shipped from Canada.

Flourens, GUSTAVE (1838-71). French politician. The son of the physiologist, Marie J. P. Flourens (1794-1867), known as the associate of Cuvier, he was born in Paris, Aug. 4, 1838. He began life as a lecturer and writer, but was soon associating with revolutionaries in Italy and elsewhere. In Feb., 1870, he headed a futile rising against Napoleon III, and after the abdication of the emperor he was one of the leaders of the commune. He was killed during the fighting at Rueil, April 3, 1871.

Flour Mill. Building equipped for grinding grain, especially wheat, into flour. The application of steam power to millstone grinding in 1784 led not only to improved

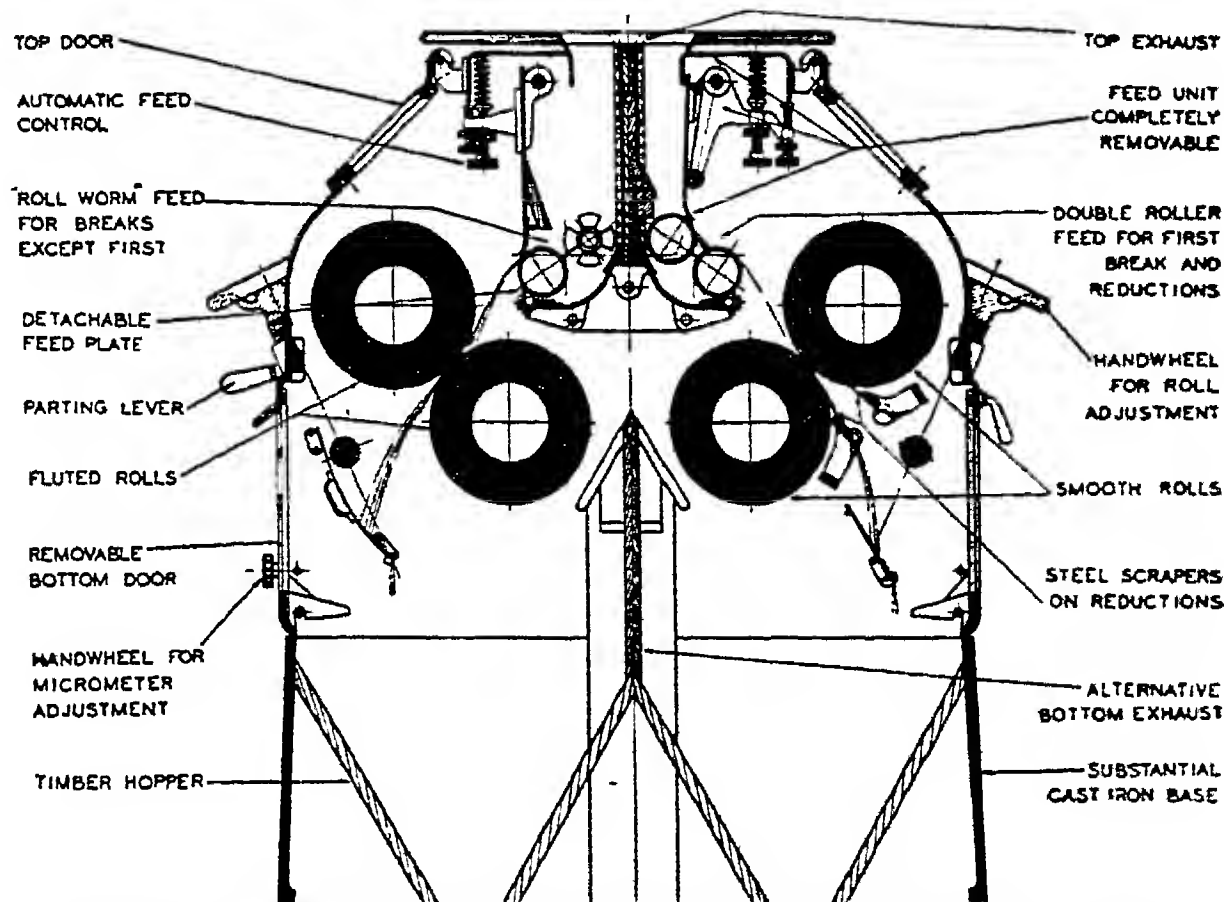


Flour Mill. Longitudinal section of the milling separator shown in the photograph above. The flow of grain and the air currents are indicated

methods of direct reduction, but also to the invention of systems for gradual reduction by means of rolls. Millstones are still used for whole wheatmeal, oatmeal, and other grain and pulses. The stones—French burrs, Derbyshire peaks, or composition disks—are usually 1 ft. thick and 4–4½ ft. in diameter, scored with straight furrows tapering to ¼ in. in depth. The upper stones rotate at a maximum of 150 r.p.m.

Although small hand-turned roller mills were produced casually from the 16th century, it was not until 1837 that Sulzberger, a Swiss engineer, founded the modern iron roller system. Porcelain rolls, introduced in 1870, have now long been discarded. Roller mills were erected in Glasgow in 1872 and in Dublin in 1878. For some years stones and rolls were employed in the same mills. But after 1881, when an exhibition was held in Islington, British millers rapidly adopted the roller system, which today deals with all but a minute fraction of the flour milling of the world.

Roller mills are equipped with silos or granaries, containing storage bins of wood, steel, or ferro-concrete, and are filled from the intake plant consisting of bucket type elevator or pneumatic conveyors that can be lowered into ship holds, and deliver the grain on to horizontal screw or hand conveyors over the bins. Road or rail wagons discharge grain into silo wall hoppers. The grain is drawn from the bins for cleaning, which is effected by milling separators using a system of sieves and air currents. Magnets retain stray iron objects such as nails, and the grain is next subjected to scouring to loosen remaining husks and surface dirt. Cockle and barley cylinders follow; these have indents shaped so as to catch smaller and reject larger seeds respectively. Most grain requires washing; and wheat is next dried or mellowed to bring it into the best physical state for milling. A roller mill stand contains two pairs of chilled iron rolls set diagonally and rotating at differential speeds. Break rolls are corrugated spirally with saw-tooth



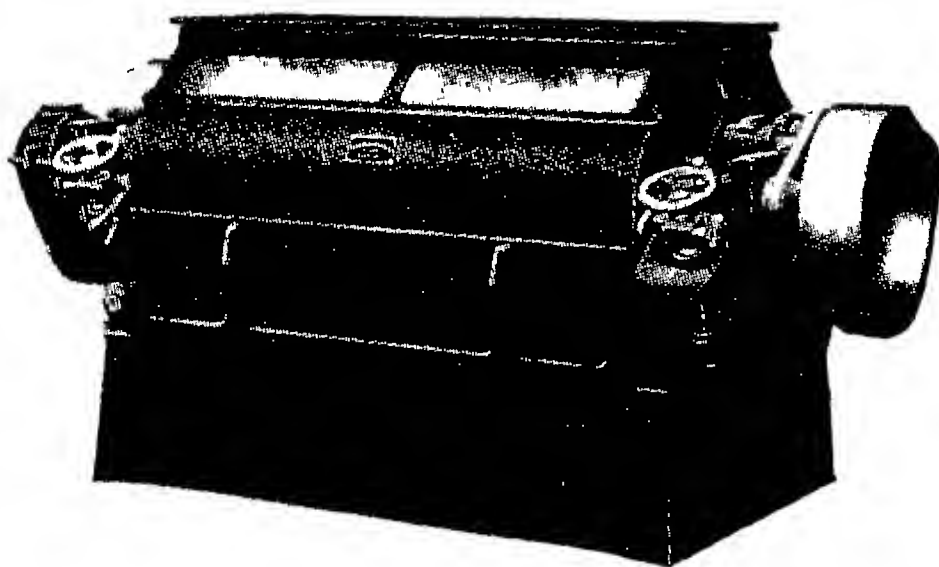
Flour Mill. Sectional drawing showing the construction of the diagonal roller mill

grooving, ranging from 10–26 per inch. The rolls may be 9 or 10 ins. in diameter, and 15 to 60 ins. long, the speed of the fast or cutting roll being 350 r.p.m., the bottom holding roll rotating 2½ times as slowly. There are usually four or five break roll passages with a sieving process between each to pass the released endosperm particles into the remaining milling processes, where they are graded according to size into

whole process from raw grain to flour sack is automatic.

Flow. Term used in metallurgy to describe the effects of certain types of deformation on metals. When a metal is submitted to stress, it first deforms elastically, but once the elastic limit has been exceeded plastic flow takes place and the metal becomes permanently distorted. Although this seems similar to the flow of water, there is no question of liquefaction of the metal, as flow takes place at temperatures far below the melting point and is really analogous to the flow of ice in a glacier. One well-known example from ancient times is the movement or creep of lead down roofs of cathedrals and churches.

A metal is built up of crystals and each crystal is composed of a group of atoms in a regular pattern; in many metals the pattern is cubic. If a series of such adjoining cubes be considered, the atoms seem to be arranged on crystallographic planes, along which shear or gliding or slipping might be expected to take place more readily than along planes with atoms irregularly spaced. In fact slipping takes place on certain planes so that the metal moves in "blocks"; this block movement forms steps on a polished metal surface, which may be seen under a microscope as straight lines. In a normal metal of many crystals, slip starts in only a few; this movement redistributes the stress and other crystals become affected. Eventually the grain boundaries change in shape and the crystals become elongated in the direction of flow, giving a characteristic "flow structure," with all the long,



Flour Mill. Diagonal roller mill containing two pairs of chilled iron rolls rotating at differential speeds
Courtesy of Thos Robinson & Son, Ltd., Rochdale

semolina, middlings, and dunst. These granular stocks are purified by a combination of sieves and air currents which plant light particles of bran fragments over the sieves. The sieves grade the purified stocks to the various smooth reduction rolls, which have a differential speed 5 : 4, the top fast roll being driven at 250 r.p.m. They reduce the granular stocks into flour in successive stages and also flatten any germ or bran particles present. Where it is desired to mill the germ into the flour, finely fluted rolls are used on certain passages. The

fibrous crystals packed parallel to each other. The mechanism is not yet clearly explained.

Plastic flow takes place more easily at elevated temperatures, though still well below the melting point of the metal. In industry metals are caused to flow by such processes as forging, drawing, extrusion, and rolling. These processes may be carried out either hot or cold. *See* Annealing; Deformation; Elasticity.

Flower (Lat. *flos*, stem, *flor*-, flower). Part of a plant containing the organs of reproduction. In the complete flower it consists of four distinct whorls of organs, which differ in form and number in different species; one or more of the sets of organs being sometimes absent. The lower or outer set are the calyx-leaves, which form the bud of the unopened flower; separately they are known as sepals, and are usually green. The second series are corolla-leaves, mostly brightly coloured, separately known as petals. The third series are stamens, consisting of a stalk or filament and the anthers, the latter containing pollen—the male cells. The fourth series is the pistil, which consists of the ovary, containing ovules or seed-eggs, surmounted by a stigma or stigmas which may be supported by stalks or styles. Grains of pollen caught by the sticky or rough surface of the stigma send out tubes which penetrate the style and fertilise the ovules, which then develop into fertile seeds.

Sometimes the sepals are all joined together and can only be spoken of as the calyx. Similarly, the petals may be united to form a tube, and be funnel-shaped, bell-shaped, urn-shaped, etc. Where there is no distinction between sepals and petals (as in the crocus and daffodil) the floral envelope is termed the perianth. In the Gymnosperms (Conifers) there are neither sepals or petals; and in other forest trees these organs are often very small and inconspicuous, because the pollen is carried by the wind. As a general rule, where the petals are brightly coloured the pollinating agents are insects—mainly bees, butterflies, and moths. Each particular type of flower has its own group of pollinating insects.

In the majority of such specialised flowers nectar-producing glands are so placed as to make certain the transfer of pollen from one flower to the stigma of another by insect agency. So also the streaks, or lines of dots, of a

second colour on the petals point to the position of the nectar. The long tubes of certain flowers (tobacco, convolvulus, etc.) are related to the long probosces of the larger moths and butterflies; broad, open flowers like buttercups to beetles, etc. The perfume emanating from flowers attracts insects—bees, butterflies, and moths. On the other hand, some flowers, such as those of the stapelias, arum family, etc., emit fetid odours attractive only to flies, which are their pollinating agents.

Flower, SIR (WALTER) NEWMAN (b. 1879). British publisher and man of letters. Born at Fontmell Magna, Dorset, July 8, 1879, he was educated at Whitgift School, and joined the publishing firm of Cassell's in 1906, later becoming director, a position he resigned in 1946. He possessed a fine collection of books, MSS., etc., relating to Handel, of whom he published a biography 1923. Flower also edited the journals of Arnold Bennett, published in 3 vols., 1932–33. He was knighted in 1938, and in 1950 brought out a volume of autobiography, *Just as it Happened*.



Flowering Rush. Foliage, buds, and flowers of *Butomus umbellatus*

Flowering Rush (*Butomus umbellatus*). Perennial marsh herb of the family Alismaceae. A native of Europe and Asia, it has a stout, creeping rootstock, from which the slender leaves rise erectly to a height of 3 ft. or 4 ft. The tall flower-scape is leafless, and bears at its summit an umbel of many rose-red flowers, each 1 in. across, of which only a few open at one time.

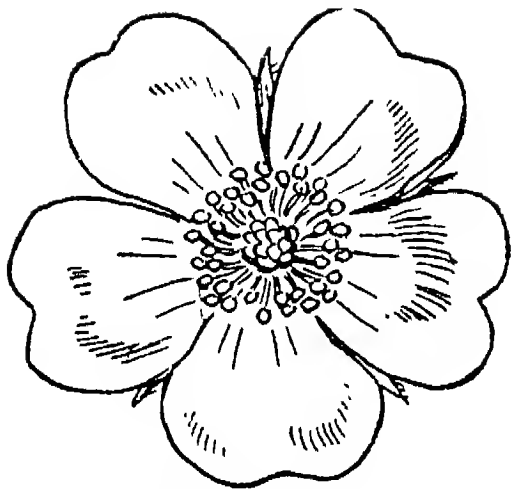
Flower of Jove (*Lychnis flo-jovis*). Perennial herb of the family Caryophyllaceae. A native of Europe, it is covered with white, silky hairs, and has lance-shaped, stem-clasping leaves in pairs. Each branch of the stems ends in a small cluster of purple or scarlet flowers of the campion (*q.v.*) type.

Flowers, LANGUAGE OF. Custom said to derive from the East, by which a particular sentiment is attributed to every flower, so that a bloom or posy may convey a message. Little volumes in which the language of flowers was set out were popular in England in the mid-part of the 19th century. Gorse, for example, indicates enduring affection; jonquil, reciprocated affection; eglantine, I wound to heal, etc.

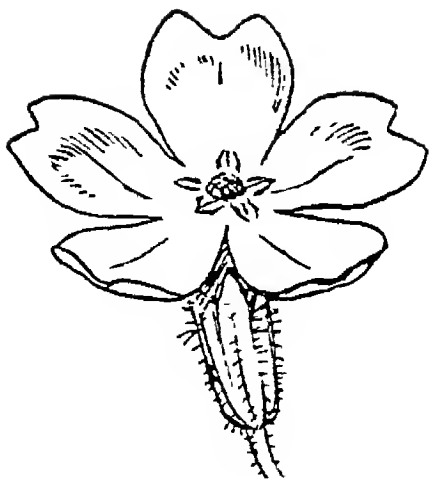
Flower Show. Horticultural exhibition, held for the purpose of encouraging the cultivation of plants, flowers, fruit, and vegetables. Exhibits may be competitive or non-competitive. The Royal Horticultural Society holds shows at fortnightly intervals throughout the year at Westminster. Local societies exist in most towns and many villages, annual shows being held, usually in Aug. or Sept. Hundreds of allotment associations also hold annual shows. In general the regulations for a flower show in the U.K. should be those laid down in the R.H.S. publication, *Rules for Judging*, but it may be advisable to require a smaller number of specimens than that specified for London shows. The schedule committee should avoid ambiguity in the wording of the classes, and use the expressions "kind" and "variety" correctly. The conditions under which challenge trophies are to be awarded should be clearly defined.

In selecting produce for exhibition the size of fruit and vegetables should be that which is best for table use. Beyond a certain point, size may become a defect. Only one variety should be shown in a dish or vase, unless a mixture is specifically asked for. Uniformity of specimens composing a dish is regarded as meritorious; unevenness in size or colour is a fault. With fruits the natural bloom should be preserved, and polishing of, *e.g.*, apples should tell against an exhibit. All vegetables should be perfectly clean, but root vegetables should be washed carefully. The use of oil to produce an appearance of freshness should be regarded as a fault. All produce should be labelled with the varietal name, as information enhances the educational value of a show.

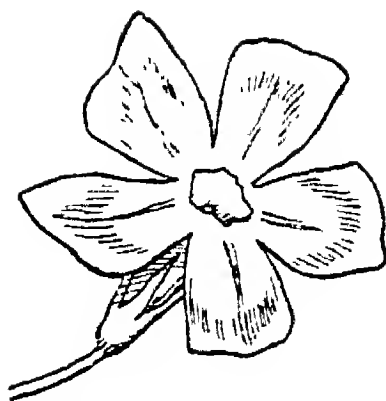
The most important flower show in the U.K. is the annual exhibition held in May in the grounds of the Royal Hospital, Chelsea, and known throughout the world as Chelsea Flower Show. There nearly all the exhibits are non-



Regular : wild rose



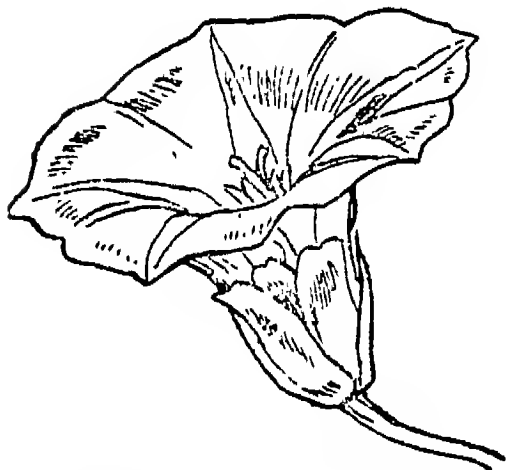
Salver-shaped : primrose



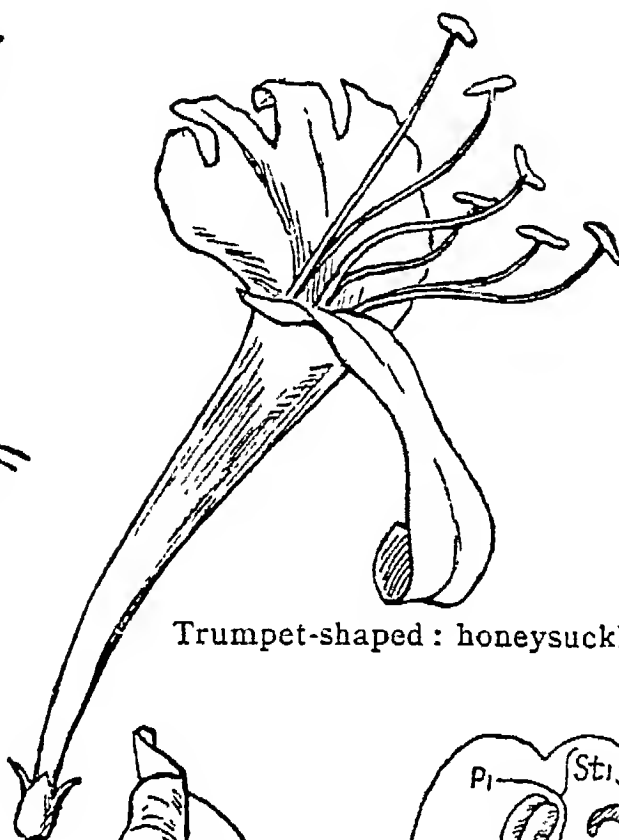
Rotate or wheel-shaped : periwinkle



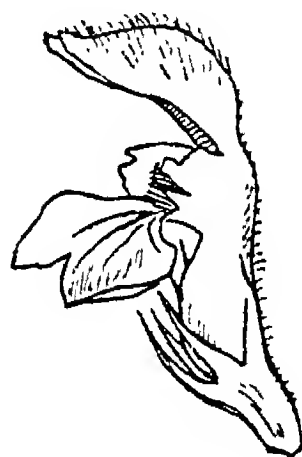
Campanulate, or bell-shaped : harebell



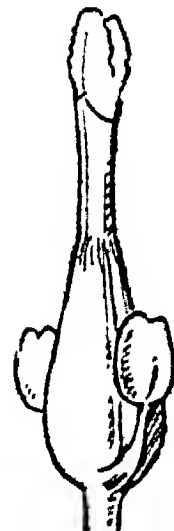
Funnel-shaped : bindweed



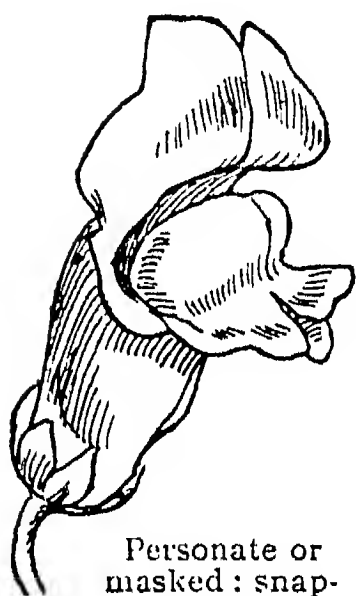
Trumpet-shaped : honeysuckle



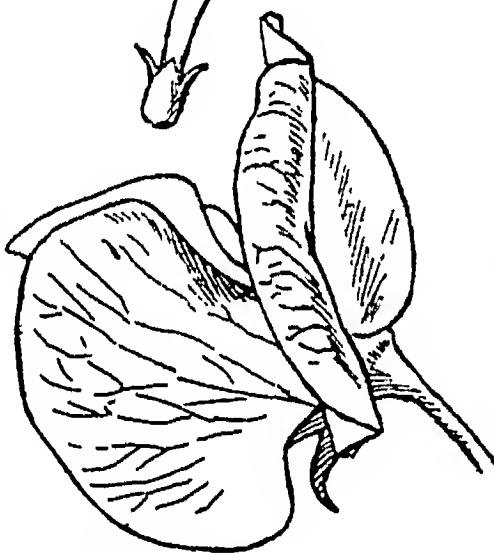
Labiate or two-lipped : dead-nettle



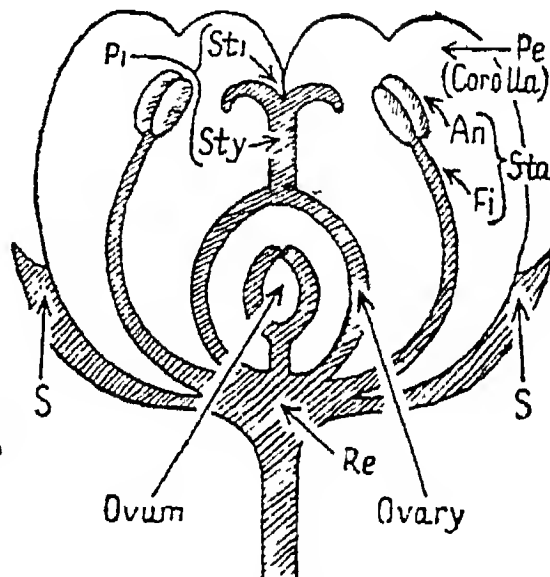
Apetalous or without petals : ash



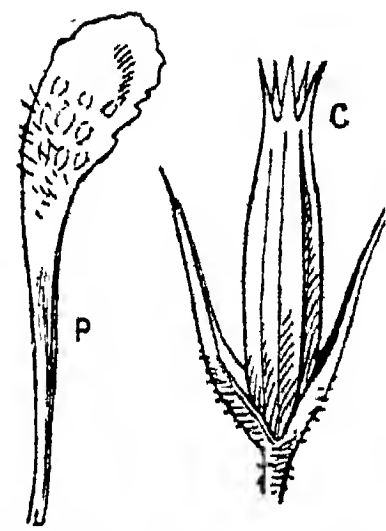
Personate or masked : snap-dragon



Papilionaceous or butterfly-shaped : sweet pea



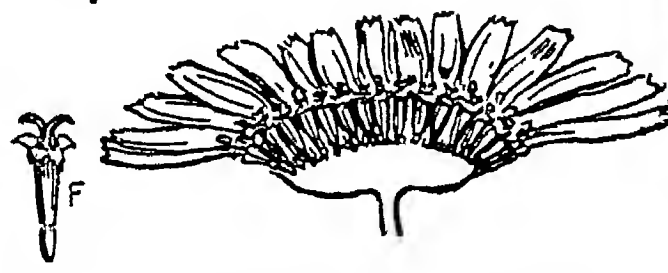
Diagrammatic section of flower. An., anther ; Fi., filament ; Pe., petals ; Pi., pistil ; Re., receptacle ; S. sepals (calyx) ; Sta., stamen ; Sti., stigma ; Sty., style



Flower of pink. P., petal ; C., calyx, showing arrangement of hidden parts



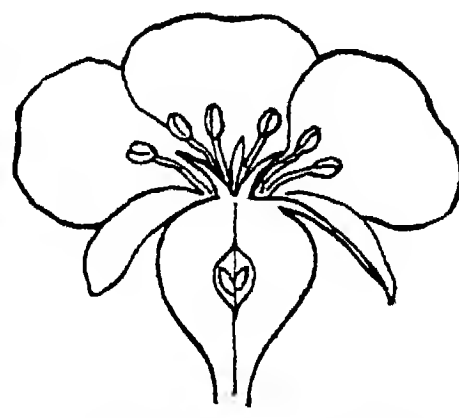
Trumpet-shaped : daffodil. C., corona ; S., spathe



Section of composite flower with florets crowded on disk ; F., floret



Superior ovary : primrose



Inferior ovary : flower of apple



Dioecious or unisexual : willow ; left, male ; right, female

FLOWER : DIAGRAMS OF THE STRUCTURES OF FLOWERS AND THEIR PRINCIPAL PARTS

competitive, and include not only large groups of plants, flowers, fruit, and vegetables, staged in huge marquees, but also rock and formal gardens constructed in the open, and displays of every conceivable horticultural requisite, from a flower vase to a conservatory and from a budding knife to a motor tractor.

Fludd OR FLUD, ROBERT (1574–1637). An English physician and mystic. Born at Bearsted, Kent, he was educated at S. John's College, Oxford, and took his degree of M.D. at Christ Church. He studied chemistry abroad, where he adopted many of the views of Paracelsus (*q.v.*). Returning to England in 1605, he became a fellow of the College of Physicians. Known as "the Searcher," under the name of Robertus de Fluctibus, he wrote many works in Latin, engaged in controversy with Gassendi, Kepler, and Mersenne, and is believed by some to be the inventor of the barometer. As the supposed author of the *Summum Bonum*, 1629, and an apology for Rosicrucianism, 1617, he is credited by De Quincey with being "the immediate father of Freemasonry." He founded a philosophy on the Hebrew scriptures. He died in London, Sept. 8, 1637. See *Freemasonry*; *Rosicrucians*; consult also Robert Fludd, *Life and Writings*, J. B. Craven, 1902.

Flüela. Mt. pass of Switzerland, in the canton of Grisons. It extends between the Schwarzhorn and the Weisshorn, on the carriage road from Davos to Sus. On the latter mt., at an alt. of 7,835 ft., is the Flüela hospice. The road has refuge galleries, used in winter.

Flüelen. Village of Switzerland, in the canton of Uri. It stands at the head of Lake Uri, a S.E. extension of Lake Lucerne, 2 m. N.N.W. of Altdorf on the St. Gothard rly. The port for Altdorf, it is the terminus for lake steamers. The Axenstrasse carriage road, constructed in 1863–65, leads from here to Brunnen. The village has a château and several hotels.

Fluellen. Character in Shakespeare's *Henry V*, a Welsh officer in the king's army. Of hasty temper and verbose speech, he is ever ready to compare the fighting of his day with that of the ancients.

Flügel Horn. Brass instrument. It is similar to the cornet, but of wider bore, like the bugle, and of mellow, horn-like tone. It is a modern improvement of the key bugle. The soprano instrument is the most usual. The term means wing horn. See *Cornet*.

Fluid. That form of matter which takes the shape of the vessel containing it and is characterised by its inability to resist permanently any applied shear stress, however small. Liquids and gases are both known as fluids; a liquid is distinguished by possessing a free surface if it does not completely fill the containing vessel, whereas a gas expands to take up all the available space. Furthermore a liquid is much less compressible than a gas. The distinction between a solid and a liquid is not always easily defined, for some so-called solids actually flow, although at a very slow rate. The flow of pitch at room temperatures is an example, and even lead can be made to flow under certain conditions. See *Flow*.

Fluid Measures. Nearly all fluid measures have been derived from corresponding measures of length or weight and suffer all the variations of the latter which were taken from parts of the human body. It is only within comparatively recent times that fluid measures have become standardised by law in different countries. In the United Kingdom the gallon is the unit measure for fluids, and in countries where the metric system is standardised the litre is the unit. A gallon contains a little over four and a half litres. See *Weights and Measures*.

Fluke. Group of trematode worms of parasitic nature, usually leaf-shaped. One, the liver fluke (*Fasciola hepatica*), in its adult condition lives in and devours the liver of the sheep, causing the much-dreaded "rot." The eggs pass out of the body of the sheep with the dung, and if they fall in a wet place hatch out into tiny ciliated embryos that swim about in search of a small water snail (*Limnaea truncatula*), perishing in about eight hours if unsuccessful. Within the body of such a snail other stages of life are passed, until finally one shaped like a minute tadpole is attained (*cercaria*). This leaves the snail and swims to a stem or leaf of grass, to which it attaches itself, and passes into an encysted or dormant stage. Its tail

has gone, it is covered by a hard coat, and resembles the adult fluke except in size.

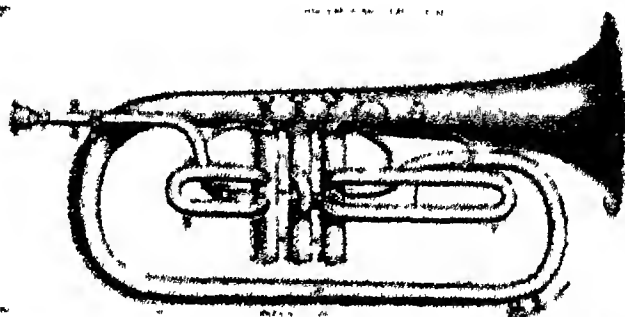
Should a sheep swallow one of these capsules or cysts, the resistant covering is dissolved by the gastric juice, and when it passes into the small intestine the tiny fluke makes its way up the bile-duct into the liver of its victim, there to increase in size and become sexually mature. The disease may be entirely prevented by keeping sheep away from damp, ill-drained land. As there is no cure for the disease, sheep showing signs of rot should be slaughtered as soon as possible. See *Sheep*.

Fluoranthene OR IDRYL ($C_{15}H_{10}$). Substance found in coal-tar and in the residue known as "stuppfeet" obtained after the distillation of mercury ores. Crude pyrene from coal-tar is converted into the picric acid compound, whence the fluoranthene is obtained in the free state and recrystallised.

Fluorescein. An aniline dye formed by heating five parts of phthalic anhydride with seven parts of resorcinol at a temperature of 200° C. When the reaction has taken place the mass becomes solid and forms a dark-brown cake. The solution in alcohol or alkalis exhibits a brilliant yellow-green fluorescence from which the substance takes its name. It is used as a dye for wool and silk—but the colour is not fast—and for preparing the liquid in druggists' show bottles. The sodium salt is used in ophthalmic practice to render visible damaged portions of the transparent cornea of the eye.

Fluorescence. The property possessed by many organic or inorganic substances of emitting visible light when subjected to ultra-violet radiation. If this emission continues after the removal of the source of the ultra-violet rays, the phenomenon is called phosphorescence (*q.v.*). Both classes of substance are included under the term phosphors (*q.v.*). Synthetic inorganic phosphors are outstandingly efficient, but many natural minerals fluoresce and a few show phosphorescence.

All having a crystalline structure, their fluorescence is believed to be caused usually by the presence of an impurity, such as copper or manganese, in the lattice. This impurity is known as an activator. Ultra-violet radiation excites these fluorescent centres by increasing the energy of certain electrons. After excitation the electrons return quickly to their normal



Flügel Horn. Improved model of B flat horn

By courtesy of Hawkes & Son

condition, giving up the induced energy in the form of visible light. In phosphorescence the energy of excitation is stored before being released in a similar manner.

Although at least 60 mineral species have shown fluorescence (including uranium and other radio-active minerals), only two, scheelite and powellite, invariably fluoresce. As scheelite is an important ore of tungsten and often resembles the worthless minerals with which it commonly occurs, its fluorescence has been used as a means of detection and for prospecting. Portable short wave ultra-violet lamp units are used underground in several mines. The colour of the emitted light may vary for the same mineral; scheelites have been examined which fluoresce with a blue, yellow, or brown colour; fluorspar often gives a purple; some calcites pink; uranium minerals, yellow or green. Crude petroleum is fluorescent, and oils can be correlated with specific sand beds by their fluorescent colours. Applications of fluorescence in biology, medicine, etc., are numerous. *Consult Fluor-chemistry, J. de Ment, 1945.*

Fluorescent Lamp. Method of illumination. Attempts were first made over a century ago to design a discharge tube that would act as a practical illuminant. Moore in 1904 came near success with his long tube of up to 180 ft., supplied by a high voltage transformer, but two difficulties still had to be overcome. The light efficiency was not sufficiently high in comparison with other lamps, and the residual gas filling of nitrogen or carbon dioxide gradually disappeared. Both defects have been removed by the modern fluorescent lamp.

It was found by Claude in 1910 that if one of the inert gases (helium, argon, neon, krypton, or xenon) was used as the residual filling, this disappearance was almost negligible. The addition of mercury to neon, or to neon and argon mixed, improved the efficiency and the colour, while the vacuum remained sufficiently constant for at least 1,000 hours. Secondly, the discharge from these gases was found to contain a large ultra-violet component, and a coating of special powder on the inside of the tube makes use of the invisible rays by fluorescing brightly, greatly increasing efficiency and enabling the colour to be widely varied.

The first powders were sulphides of zinc and other metals; but

more efficient "phosphors" of silicates and tungstates were discovered by J. T. Randall in 1936. The improvement is indicated by the luminous output in lumens per watt: Gas-filled filament lamp—11 Ln/W; fluorescent lamp using "green" sulphide coating—15 Ln/W; fluorescent lamp using "green" silicate coating—50 to 60 Ln/W. The modern Jenkins lamp uses pure neon, with coating of zinc orthosilicate or calcium tungstate, and possesses long life as well as high efficiency. Standard dimensions of the tubes for indoor lighting are 9 ft. long by 20 mm. diameter, but other lengths and shapes are made. Consumption is about 40 to 60 W. Many shades of colour may be obtained, including daylight.

To start these lamps, a striking voltage from 1.5 to 2 times the running value is necessary. The two voltages are obtained automatically by the use of a series choke, or by designing the step-up supply transformer with a high leakage reactance. A few seconds after switching on the tube has fully lit up, and the voltage becomes normal. Shorter and more powerful lamps are used for outdoor illumination.

Fluorides. Salts of hydrofluoric acid. They are prepared by acting on a metal, or its oxide hydroxide or carbonate, with hydrofluoric acid. Calcium fluoride (CaF_2) occurs native as fluorspar or "blue-john," and from it most of the preparations of fluorine are made. The fluorides of the alkalis are soluble in water and are employed with mineral acids or acetic acid in the processes of etching glass. Some fluorides are gaseous at ordinary temperatures, but most are stable bodies, and are not decomposed by heat. A series of double fluorides is known. Fluorides are recognized by the evolution of hydrofluoric acid on heating with sulphuric acid.

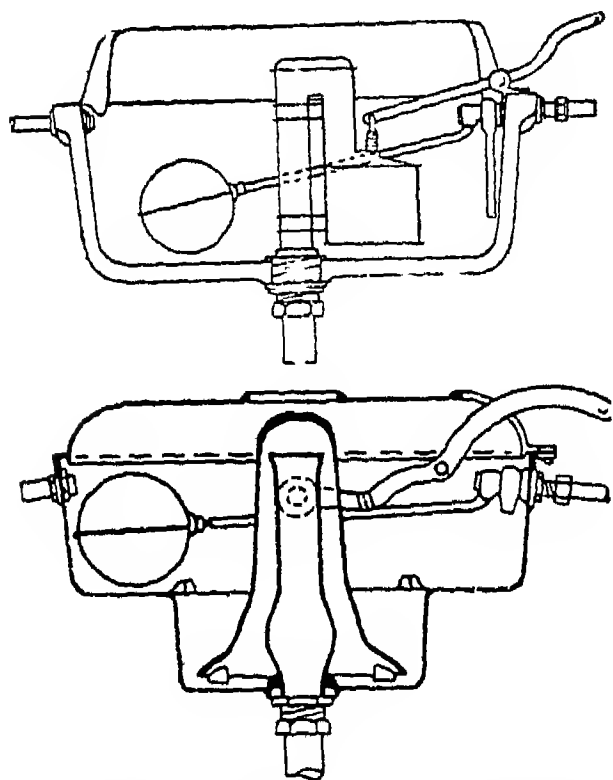
Fluorine. Gaseous element of greenish-yellow colour, first isolated by Moissan in 1886. Its chemical symbol is F; atomic weight 19, atomic number 9, boiling point -187°C . Derbyshire-spar or "blue-john" is calcium fluoride. Cryolite, a double fluoride of aluminium and sodium, is found in Greenland, and the element occurs widely throughout the mineral kingdom, but only in small amounts. Scheele in 1771 first recognized that fluorspar is a fluoride of calcium and prepared hydrofluoric acid, but all attempts to prepare fluorine were unsuccessful before 1886. It was liquefied in

1897 and solidified in 1903. The difficulties to be faced in preparing fluorine are very great on account of the extremely active chemical affinity it has for glass and most metals. Traces of the gas are very irritating to the mucous membrane, and if brought into contact with the skin the gas causes a bad burn. Alcohol, ether, benzene, and turpentine take fire on contact with fluorine. Moissan isolated the element by the electrolysis of anhydrous hydrofluoric acid to which acid potassium fluoride had been added in order to make the liquid conduct the electric current. One compound of fluorine and hydrogen is known, and one oxide, F_2O , has been prepared. Although fluorine is akin to chlorine in many properties, there are no fluorine compounds corresponding to hypochlorites and chlorates.

Fluorite OR FLUORSPAR. The natural form of calcium fluoride (CaF_2), crystallising in the isometric system. It occurs as colourless, green, blue, purple, or yellow crystals, generally massive. It has an excellent cleavage, is fairly soft, and often fluoresces blue in ultra-violet light. Fluorite is a common accessory mineral in sedimentary (dolomites and limestones) and acid igneous rocks; also found associated with ores of lead, silver, zinc, and tin, in mineral veins. Fluorite is used as a flux in the making of steel; in the manufacture of opalescent glass and enamels, and the preparation of hydrofluoric acid. The dark blue variety from Derbyshire, "blue-john," is used for ornaments.

Fluoroscope. Apparatus for the analysis of clear liquids and various materials as they fluoresce when exposed to ultra-violet light. Certain chemicals have the quality of fluorescing, or glowing, when X-rays strike them. Thus, if a plate covered with zinc sulphide is held on one side of a human hand, and an X-ray tube is operating on the other side, the bones of the hand will be outlined on the plate as shadows. As the X-rays do not penetrate the denser bone structure as intensely as they do the flesh, the bones show up as shadows on the plate. This principle is used in fluoroscopes for examining the interiors of objects. Commercial fluoroscopes can detect flaws in metals, alterations in documents, and the contents of cases and packages passing through the customs. Minerals subject to the action of a fluoroscope glow with light and colour which in ordinary daylight is unsuspected.

Flushing. The action of cleansing a sanitary fitting or drain by a sudden flow of water, usually from



Flushing. Fig. 1 (top). Section through bell-siphon flushing cistern. Fig. 2 (below). Section of inverted U-tube siphon flushing cistern

a cistern fitted with hand-operated or automatic discharge mechanism. Cisterns used with water closets have 2 to 3 gallons capacity as determined by the water supply authority. The flushing mechanism is commonly of a waste-preventing design, capable only of siphonic discharge.

Two typical arrangements are shown in Figs. 1 and 2. Siphonic action is induced by the movement of a small quantity of water down the vertical stand-pipe that passes through the bottom of the shell. The fall of this water sets up a slight downward movement of the air within the stand-pipe and the flush pipe connecting the cistern with the fitment it serves. This momentary lessening of air pressure within the stand-pipe provides the lack of balance necessary for siphonage. In consequence, the atmospheric air pressure bearing upon the surface of the water in the cistern is able to force the whole content of the cistern upwards into the stand-pipe and down the flush pipe.

In Fig. 1, the lever action that raises the bell must be followed by a quick release action, so that the descending bell may splash the requisite quantity of water into the stand-pipe. The better and quieter arrangement of Fig. 2 operates on the pull of the lever. This action raises a valved plate inside the wide, open-ended cylinder, and so lifts the water above the plate over the inverted U-tube and into the stand-pipe.

Compact flushing valves regulated to discharge only a predetermined quantity of water frequently

require a greater pressure of water than is ordinarily available. Automatic flushing is largely confined to public urinals, and to drains that cannot be laid with a self-cleansing gradient. These are commonly fed with a drip supply of water regulated to flush a urinal every 15 to 30 minutes, and to provide a drain flush once or twice in 24 hours. Several automatic flushing devices resemble the bell and stand-pipe arrangement of Fig. 1. In an automatic tank, the water would rise above the fixed, parallel-sided bell, and compress the air in the stand-pipe till the sudden discharge of this air established a siphonic discharge action.

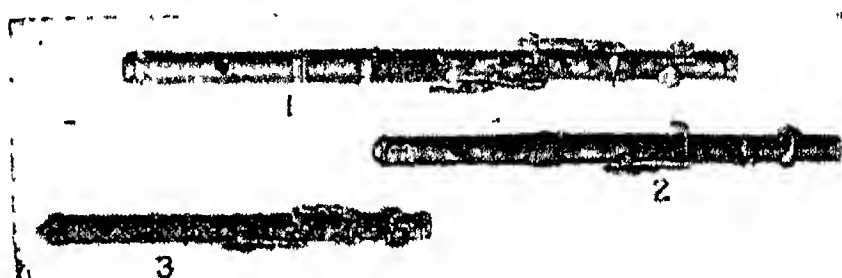
Flushing (Dutch: Vlissingen) Town of the Netherlands. On the S. coast of the island of Walcheren, it lies at the mouth of the Scheldt, in the province of Zeeland. There is direct rly. connexion across the island of South Beveland with the rest of the Netherlands. Except for shipbuilding and some rly. workshops, the town has little trade, but it is of considerable strategic importance, as its history shows. It also developed before the First Great War as a sea-bathing resort. The town was badly flooded during the great tide of Jan. 31-Feb. 1, 1953. Pop. (est.) 20,200.

In the history of the Netherlands Flushing was often prominent, especially as a naval base. It was the birthplace of Admiral Ruyter, 1607, and on the sea wall there is a monument to him which survived the Second Great War. The town was severely bombarded by an English fleet under Lord Chatham in the Walcheren expedition of 1809, but the subsequent attempt to capture Antwerp from there failed completely. The town suffered badly in the Second Great War, its port being completely

destroyed by Allied bombing and deliberate wrecking by the Germans. The dykes on both sides of Flushing were repeatedly bombed on Oct. 7, 1944, British and Canadian forces subsequently landing at Flushing on Nov. 1 and clearing the town of Germans on Nov. 4. A memorial to men of No. 4 Commando who fell in the assault was unveiled here in 1952.

Flute (Lat. *flatus*, blast). Family name of many wind instruments of the whistle type, whether blown vertically through a mouthpiece or transversely through a side hole.

Down to the end of the 18th century the number of flutes employed in the orchestra was uncertain, and on account of their weak tone several of them were often used in unison; but the modern instruments are so much improved that it is now customary to employ them singly, and the two (or occasionally three) flutes of the modern orchestra play independent parts. Flutes have been made at various



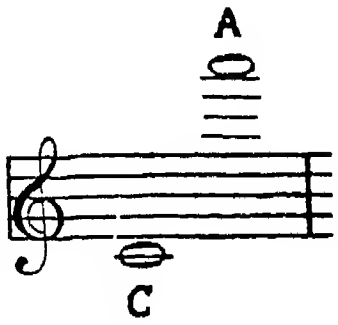
Flute. 1. Military flute, 19½ ins. 2. Military fife, 15 ins. 3. Piccolo or octave flute, 12 ins.

itches, but the scale of the open finger-holes is always called D. The transposing of flutes, other than the concert flute of ordinary pitch, has been usually reckoned from D instead of from C. Originally, the six finger-holes were the only means of obtaining a scale, and chromatic notes had to be made by cross-fingerings, half stops, and other unsatisfactory means; but key after key has been added until now all the semitones are producible, in good tune and with even tone. The convenient compass of the concert



Flushing. Dutch housewives in the fish market on the Nieuwendijk, a view taken before the Second Great War

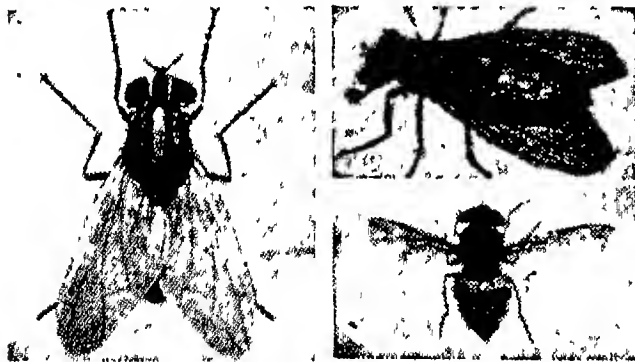
flute is as shown, and three semi-tones higher are possible. The flute is the most agile of the wind instruments, modern mechanism having reduced finger difficulties to a minimum. Flute is also the name of an organ stop imitating the tone of the orchestral instrument of the same name. A flûte-à-bec is a beaked flute, or flute with a mouthpiece, played vertically. See Fife; Flageolet; Organ; Recorder.



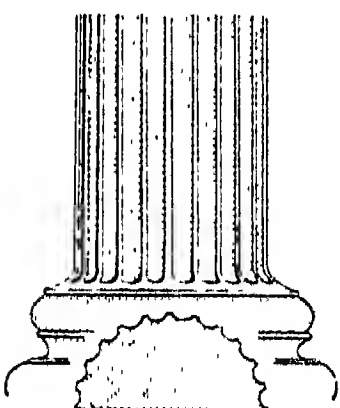
Fluting. In architecture, flutes are grooves in a column, separated usually by fillets. Fluting is generally vertical, but spiral fluting occurs in Norman architecture. See Architecture; Column.

Fluvial Deposits (Lat. *fluvius*, river). In mining geology, term for deposit of minerals dissolved from primary sources by streams etc., and laid down in concentrated masses. Such mineral concentrations are richer than those found in eluvial deposits (see Eluvial Deposits), in the formation of which flowing water plays no part.

In geology, fluvio-glacial deposits are those layers of mud, etc., thrown up by streams emerging from the terminations of glaciers. According to the slope of the glacier and the speed of its streams, the deposits' layers vary, but the



coarsest elements always fall nearest the glacier or, if discharged into water, at the base of a conical mass which is topped by the least coarse.



Fluting in Ionic column; inset, plan of fluting

Flux. Material used in metallurgical smelting, refining, brazing, soldering, and welding operations, to remove unwanted matter or to protect the metal from the atmosphere.

Mixed with the metalliferous portion of an ore, there are many other gangue minerals, which

must be removed as a slag to give clean, reduced metals. By themselves these earthy substances are usually too refractory to allow easy fusion and so fluxes must be added to combine with them, producing an easily melted, free-running slag, readily separated from the molten metal. If the ore is acidic, basic fluxes, e.g. limestone, iron oxide, or soda, are required to combine with the silica, etc., while a basic ore needs acidic substances, such as quartz or sand. Neutral fluxes, such as fluorspar or borax are sometimes added to lower the melting point of the slag. Similar considerations apply in refining and melting. Welding, brazing, and similar joining operations require fluxes to break down oxide films, and to protect the hot joint from the atmosphere. An example is the use of zinc chloride for tinning. See Gangue.

Fluxion. Term used by Sir Isaac Newton to signify the rate at which a "fluent" (or variable) increased or decreased at any given instant. The fluxion is thus the derivative of the fluent with respect to time ($\dot{x} = dx/dt$; $\ddot{x} = d^2x/dt^2$, etc.). See Differential Calculus; Newton.

Fly. Insect of the order Diptera, characterised by having only fore wings, the hind pair being modified into balancers, or *halteres*, which resemble minute drumsticks. These are sensory organs that enable the insect to maintain

equilibrium in the air. Removal of the halteres causes some flies to lose their power of balance when in flight; others fall aimlessly to the ground. The mouth-parts are adapted for sucking up liquid food, and in mosquitoes and horse-flies they include sharp lancet-like organs which enable the insects to pierce the skin of man and other vertebrates in order to imbibe blood. The pathogenic agents of such virulent diseases as malaria, sleeping sickness, yellow fever, and elephantiasis are transmitted to man through blood-sucking flies.

Flies undergo complete metamorphosis: their larvae are always devoid of legs, and those of the house-fly and blowfly, for example, are without an evident head and are known as maggots. In gnats or mosquitoes, and among midges, the larvae are aquatic, and are variously modified to suit that mode of life.

In several families, the larvae are parasites living in the bodies of mammals (botflies and warbleflies), or in other insects (tachinid flies).



Fly. Foot of house-fly, highly magnified

The larvae of many flies are injurious to food crops, notably those of the crane flies, known as leather-jackets; the fritfly, to oats; the goutfly, to barley; and the beet or mangold fly. About 85,000 different species of flies are known, over 5,200 kinds occurring in the British Isles. See House-Fly.

Fly. The largest known river of New Guinea or Papua. It rises among the Victor Emmanuel Mts. in the E. part of the island, and flows S.W. and then S.E. to discharge its waters into the Gulf of Papua by a long, wide estuary. For part of its course it forms the frontier between Dutch and British New Guinea. It has a length of about 620 m., and is navigable for small craft nearly all the way. The principal affluents are the Alice and Strickland rivers.

Fly-agaric (*Amanita muscaria*). Large toadstool of the family Agaricaceae. It has a creamy-white stem and gills, the former with a broad soft frill around its upper part. The upper side of the cap is orange-scarlet, flecked with irregular particles of white—the remains of an outer envelope. Well known as a poisonous species, it was formerly employed for



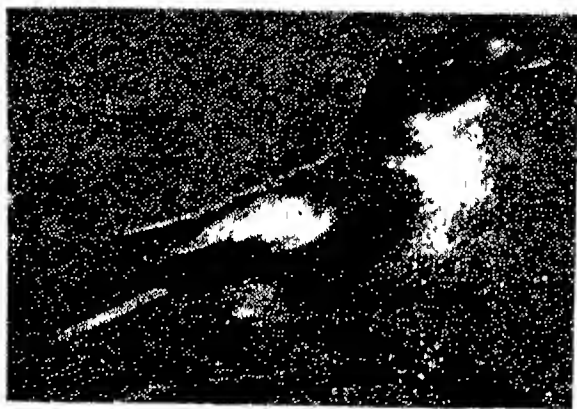
Fly. 1 and 2. House-fly, *Musca domestica*. 3. Girdled drone fly, *Volucella inanis*. 4. Gold-girdled fly, *Chrysotoxum bicinctum*. 5. Dung fly, *Scatophaga stercoraria*. 6. Humble-bee fly, *Bombylius major*. 7. Pupae of house-fly.



Fly-agaric. The poisonous scarlet toadstool, *Amanita muscaria*

poisoning fly-papers. It has also intoxicating properties, and is used in Kamchatka in preparing vodka.

Flycatcher. Name of family (*Muscicapidae*) of small birds, including nearly 300 species. All feed upon insects, which they usually catch on the wing. The tail is in most species considerably shorter than the wing, and while the European species are plainly clad in sombre hues, some of the tropical ones are very gorgeous. The pied flycatcher (*Ficedula hypoleuca*) comes to Great Britain in the spring, the spotted flycatcher



Flycatcher. The pied flycatcher, a spring visitor to Great Britain

(*Muscicapa striata*) in the summer, and the red-breasted flycatcher (*Siphia parva*) is occasionally seen in autumn. See Egg, colour plate.

Fly Fishing. Fishing with an artificial fly. The flies are made of feathers, silk, tinsel, fur, and other materials. Trout-flies, especially those used in the dry-fly method, are made to resemble as closely as possible some form of fly or other aquatic insect.

The fly, which is attached to the line by a cast of gut of a thickness varying with the shyness of the fish, the colour of the water, and other conditions, may be either sunk deeply in the water, or fished wet near the surface, or floating. The opinions of experts differ about the value of colour in artificial flies, as compared with their size and form, but all agree that the principal factor in success is the way in which the fly is presented to the view of the fish. Recent experiments in underwater photography have done much to confirm the view that, when fished "dry" or floating, the important factor is the fly's silhouette as seen against the light.

It is essential in fly fishing for the angler to keep himself and his rod out of sight of the fish, and this condition is usually ensured by keeping low when fishing up or across a stream, and by using a long line when fishing down stream or casting over a loch. Correct casting requires skill which can be attained only by practice. Where the surroundings permit, the rod can be kept up and the cast made overhead; it can also be made underhand, or the line can be got out by the Spey throw or other such methods, such as the downward cut employed against the wind. The best sport to fishermen with the fly in the United Kingdom is given by salmon, sea-trout, brown trout, and grayling.

Fly fishing with natural flies is another method, but, owing to the difficulty of keeping them on the hook when casting, the method of dapping is employed. The fly is dropped on the water and raised again with a short line, or a long rod is used with a light blow-line, taken out by the wind. See Angling; consult also Fly Fishing, K. Rollo, 1946; New Lines for Fly Fishers, W. B. Sturgis and E. Taverner, 1946.

Flygare-Carlén, EMILIE SMITH (1807-92). Swedish novelist. Born at Stroemstad, Aug. 8, 1807, in 1827 she married Axel Flygare, and was left a widow in 1833. She published her first novel, Vladimir Klein, in 1838, under the pseudonym "Fru F." In 1841 she married John Gabriel Carlén, lawyer and man of letters, and continued to write stories, largely concerned with the life of the Norwegian coast. She died at Stockholm, Feb. 5, 1892. Many of her novels have been translated into English, including *The Rose of Tistelton*, 1844; *The Birthright*, 1851; *The Guardian*, 1865. Her collected novels were published in 31 vols., 1869-75, and her *Reminiscences* in 1878.

Flying-Boat. A class of sea-going aeroplane, the essential feature of which is a boat-like hull. The majority of modern seaplanes, especially the larger designs, are flying-boats; float seaplanes or floatplanes being the other main division.

The hull provides buoyancy on the water, and also takes the place of the fuselage of the landplane,

normally accommodating the crew, passengers, and/or freight or armament. The flying-boat has small wing-tip floats which may be retractable in flight, or alternatively sponsons on the side of the hull itself. Flying-boat designers and operators have adopted many of the terms of marine engineering, including keel, chine, bow, stern, etc. The keel has one or more steps breaking its outline; a flying-boat takes off from and alights on the planing bottom, which is in advance of the front step. The engines and airscrews must be kept clear of spray, and these are therefore slung high; the same applies to the tail surfaces.

As a flying-boat is independent of runways and airfield restrictions, many of the world's largest aircraft have come into this category—examples were the Dornier Do X of 1929, which once carried 169 passengers, Hughes Hercules of 1947 (wing span 320 ft.), and the Short Princess of 1950. The most notable British flying-boat and the largest standard R.A.F. aircraft during the Second Great War was the Sunderland. The Walrus was an amphibian flying-boat, permitting operation from land or water. With the development of the large jet-propelled airliner with wheeled under-carriage the flying-boat went out of use, except for a few Empire flying-boats which for some years after the Second Great War maintained services between the U.K. and Mediterranean countries.

Flying Bomb. Name given to a jet-propelled weapon used during the Second Great War. Experiments were made in Great Britain in 1916 and in the U.S.A. in 1918 with pilotless aircraft, and in Great Britain about 1926-27 with a radio-controlled pilotless bomber called Larynx, but none of these was further developed. During the Second Great War, however, the Germans invented what they called *Vergeltungswaffe Eins* (V 1, or Reprisal Weapon One), giving it the code number FZG-76. Frequently referred to in Great Britain as the V 1, it was officially named in that country the flying bomb. Other names, more colloquial, included buzz bomb and doodlebug.

The flying bomb had several wing variations. One model had 16-ft. span wings, tapering in plan from the body to cut-back wing tips; the other had parallel chord 17½-ft. span wings. Sharp steel strips were fitted inside the wings' leading edges to cut

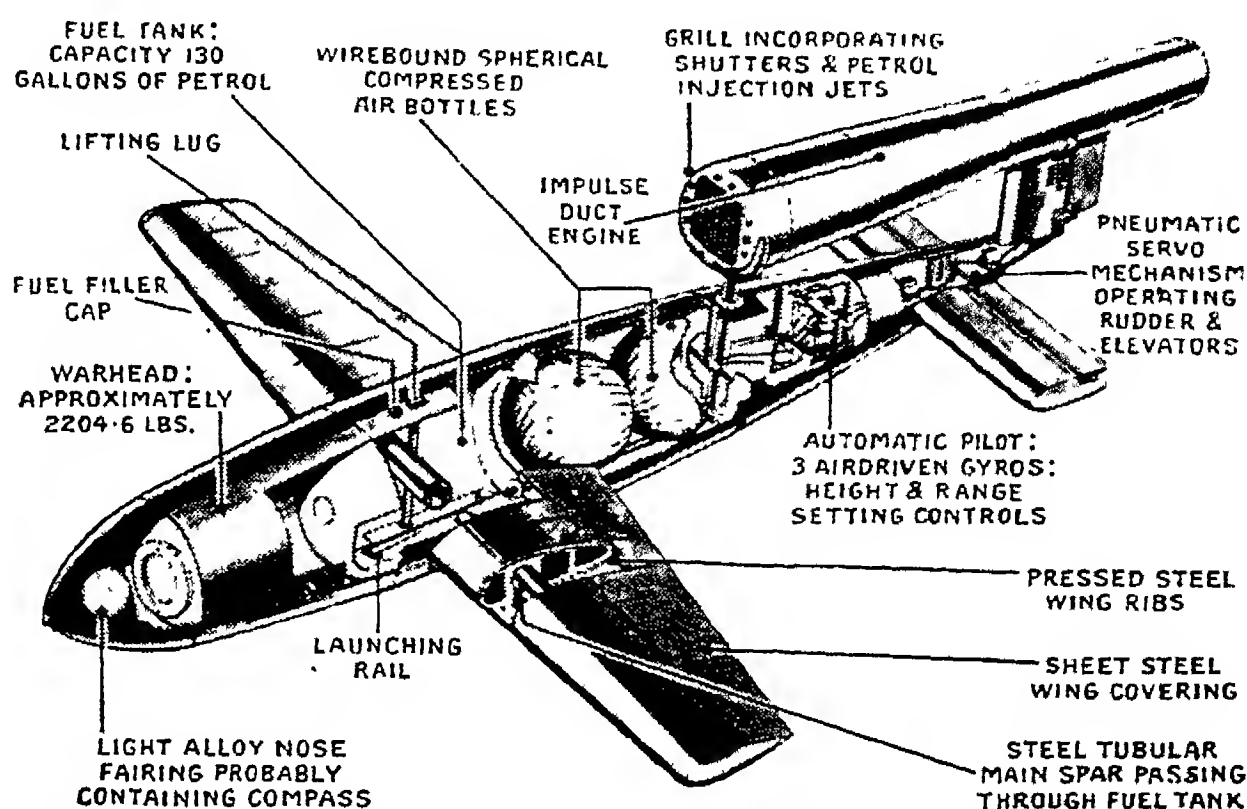
balloon cables. No model had ailerons. Other dimensions were: fuselage, length 21 ft. 10 ins., and maximum diameter 2 ft. 8½ ins.; propulsion unit, 11 ft. 3 ins. long, 1 ft 10½ ins. maximum diameter; the jet tube projected behind the rudder, and the overall length was 25 ft. 4½ ins.; tail plane span, 7 ft. 5 ins. Almost entirely of mild-steel sheet, the nose section, containing the magnetic compass, was of duralumin, to reduce compass deviation. Gross weight was 4,700 lb. made up thus: shell, about 1,800 lb., explosive 1,870 lb., fuel about 950 lb. with tankage for about 130 gallons.

The propulsion unit was a simple welded-steel casing mounted above the rear of the fuselage on a front fork and on the fin aft. Air, compressed at very high initial pressure and contained in two wire-reinforced spherical bottles, forced fuel from the tank through pipes running up the front support of the propulsive-unit. This fuel was sprayed into the combustion chamber through nine atomiser jets arranged in three rows of three between a venturi grill. Three compressed-air jets for starting the engine were mounted above the topmost fuel jets. In front of the jets was a square "honeycomb" of non-return valves made of 126 double leaves of pen-nib steel, with each double leaf pressing its two inner edges together. In front of this honeycomb was the circular air intake.

The fuselage contained six sections for the compass, warhead, fuel tank, air bottles, gyroscopes and controls, and servo-motor. Under the fuel tank centre-section a fore-and-aft launching rail with thick metal sides tapered from front to rear.



Flying Bomb. The machine climbing after being launched from its ramp on the French coast



Flying Bomb. Sectional drawing of the pilotless plane used by the Germans to bombard London in the summer of 1944

Flying bombs were brought from assembly shed to launching ramp on a trolley. A derrick travelling on rails, one on either side of this ramp, lifted them on to the ramp by the lug above the wing spar. The gyroscopes were driven by compressed air from the air-bottles in the adjoining section. Bearings from the repeater compass in the nose were used to maintain the course through the master gyroscope (see Automatic Pilot). A pre-set aneroid barometer controlled the height of flight, and an air log set to the estimated distance governed range.

Launching was controlled from a blast-proof control-house about 30 yards from the upward inclined ramp, and was effected by a piston driven by compressed air within a cylinder that ran the full length of the ramp. A sprag on the piston projected through the upper wall of the cylinder and engaged with the launching rail of the flying bomb. At the end of its run on the ramp the flying bomb rose abruptly into the air, and climbed to its pre-set height before flying level. But not all flying bombs started successfully; a number fell back, causing damage to the launching sites and injury among the launchers.

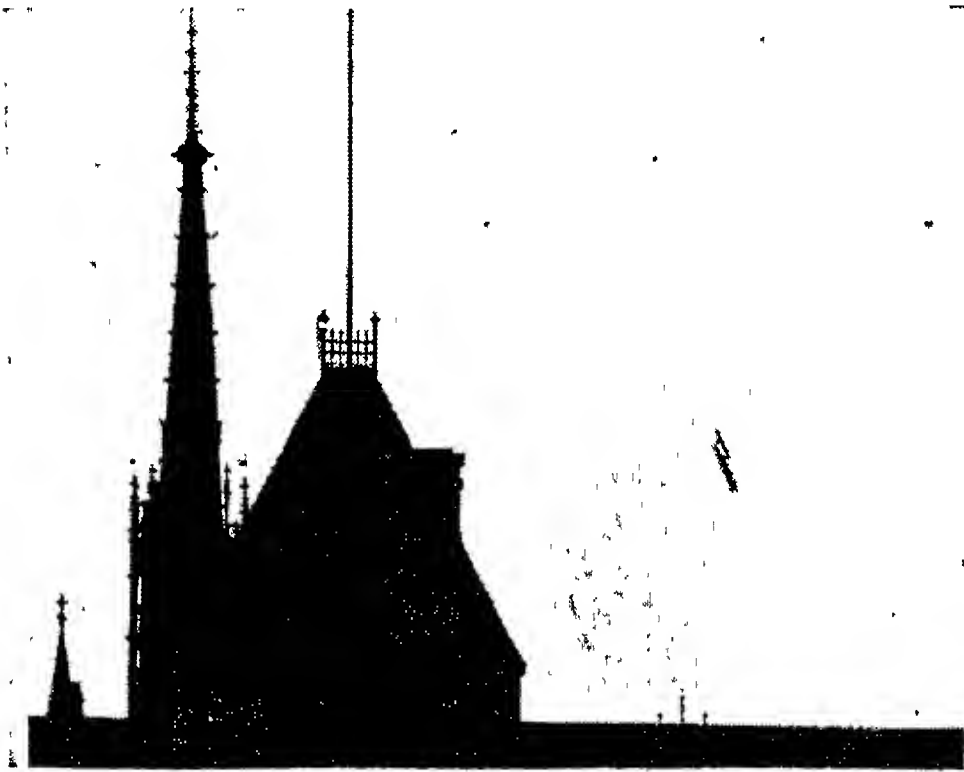
Launching speed was about 185 m.p.h., and had to exceed 170 m.p.h. to open the air valves and start the normal operational cycle of the engine. During flight, the air log was rotated backwards by a calibrated air-screw of about 12 ins. diameter mounted in front of the fuselage nose. When the estimated range had been flown and zero reached on the log detonators attached to the tail plane were electrically fired. These forced down two

control tabs, which in turn forced the bomb into a dive. The warhead had (1) a sensitive impact fuse; (2) a universal mechanical fuse with one switch at the nose and another under the warhead to detonate if the flying bomb should glide into the ground; and (3) a clock fuse to explode the bomb after two hours should the others fail. A few weapons carried small radio transmitters, enabling German receiving stations to pilot their flight.

Exploding on contact, the flying bomb made only a small crater when it landed on open ground, but the lateral blast covered a much wider area than did that of bombs of deeper penetration.

Early in 1943 British Intelligence learned through information supplied by foreign workers forced to labour in Germany that Germany was preparing a long-range weapon to bombard London. Through agents the zone, and through R.A.F. reconnaissance the exact site, of the principal experimental station was located at Peenemünde (*q.v.*), near Stettin, on the Baltic coast.

Air reconnaissance also revealed large ferro-concrete structures at Watten, in the Pas-de-Calais, and about 100 smaller structures behind the French coast between Le Havre and Calais. It was presumed that these were for the launching of jet-propelled weapons, while it was thought that the large structures were to fire rockets. All launching ramps pointed towards London. The R.A.F. and the U.S.A.A.F. heavily attacked both Peenemünde and the launching ramps, destroying all these permanent launching sites, and forcing the Germans to build



smaller but less efficient launching structures which could be rapidly assembled and camouflaged.

Just after 4 a.m. on June 13, 1944, two Royal Observer Corps members on duty at Dymchurch, Kent, spotted a flying bomb approaching, identified it instantly, and reported within 35 secs.; it proved to be the first missile of an intensive attack lasting seven weeks, and twice reaching a maximum of 200 bombs a day, aimed at London. Plans made to meet the anticipated attack were immediately put into effect.

The flying bombs flew at a height of between 800 and 2,500 ft. at a speed varying with the direction of the wind of from 320 to 400 m.p.h. This was both higher and faster than had been anticipated, and they proved difficult targets for the heavy A.A. guns detailed for the defence. The defences were therefore swiftly reorganized. (See Anti-Aircraft Command.)

Beyond the coastal gun belt, fighters had the task of destroying flying bombs which had passed the guns. They found the best method of attack in a dive at an acute angle from behind, which gave them speed in excess of the bomb. Determining the range at night was difficult, until Prof. Sir Thomas Merton invented a simple range-finder, costing about one shilling. Four types of fighter aircraft were used: the Tempest, Mustang, Spitfire XIV, and the jet-propelled Meteor. They destroyed 1,900 flying bombs, Tempests with a total of 578 brought down proving most effective, Spitfires next with over 300.

A curtain of barrage balloons, eventually totalling some 2,000, was set up to the S.E. of London, between Godstone in Surrey and the Thames near Woolwich. Their cables brought down 278 flying

bombs. (See Balloon Defences.)

Very few flying bombs were launched from France after Sept. 4, by which date the Germans in the Pas-de-Calais had been cut off from their bases by the advance of the Allies. It was estimated that from June 13 to Sept. 4, 1944, a total of 8,070



Flying Bomb. Its pre-determined range having been reached close to London's Law Courts, a flying bomb dives to earth and explodes in a cloud of black smoke. These photographs were taken from a Fleet Street roof in July, 1944

flying bombs had been launched, sometimes singly and sometimes in waves. 25 p.c. were erratic or inaccurate, and 46 p.c. were brought down by the triple defences. On Aug. 28, 97 out of 101 launched were destroyed. During the last fortnight of the main attack, only 45 p.c. of the bombs launched crossed the English coast.

Croydon was the worst-hit borough (See Croydon illus.), Wandsworth the worst-hit London borough. Several flying bombs fell in Norfolk, and one fell at Northampton. Flying bombs destroyed in S.E. England 23,000 houses, damaged more than 1,100,000.

After the main attack was over, a few flying bombs arrived from a more easterly direction, including a number which fell in S. Lancs on Christmas Eve, 1944. These were all launched from adapted Heinkel 111 bombers. Bomber Command attacked the aerodromes from which the Heinkels operated, intruder fighters patrolled the Dutch and Belgian coasts at night, and guns were deployed in the zone of the Thames estuary.

But the main attack by flying bombs was switched against Antwerp (*q.v.*) and, during the German counter-attack in the Ardennes in Dec., 1944-Jan., 1945, to Liège.

Flying Buttress. In architecture, a half arch used to transmit the thrust or pressure of a structure, usually a vault, to a main buttress or solid foundation. Flying buttresses were first used in France in the 12th century, and formed a principal decoration of the exterior of French cathedrals.

Flying Column. Body of lightly equipped, mobile and self-supporting troops which operates for short periods at a distance from its

base. Such bodies have been used, *e.g.*, to suppress guerrillas or to relieve a beleaguered garrison. During the Second Great War notable flying columns were the Long Range Desert Group and the Chindits (*qq.v.*).

Flying Doctor. Australian medical service established in 1928 through the efforts of John Flynn (1880-1951), a medical missionary in the

"outback." Based on the use of portable radio sets in remote farmsteads and light aeroplanes at bases, it serves some two million sq. m. of sparsely populated inland country with few roads, fewer rlys., and trackless mt. ranges and desert separating habitable districts. Starting with one base at Cloncurry, Queensland, it spread to N.S.W., Western Australia, South Australia, and the Northern Territory; in 1955 there were 12 bases linked by radio with some 900 outposts.

Flying Dutchman, THE. Spectral ship traditionally haunting the lat. of the Cape of Good Hope, about which it is said to be ever moving under crowded canvas, unable to reach port. The vessel is supposed to be thus doomed owing to the abominable acts of her crew headed by their captain, Vanderdecken. Her appearance is deemed a portent of disaster. The legend inspired an opera by Wagner.

Flying Fish. Name given to several groups of tropical fish. They are in the habit of leaping out of the water to escape their

enemies, and taking long skimming flights above the surface, supported by their distended fins, which are not used as propelling agents.

Flying Fortress. American heavy bomber of the Second Great War. Known to the U.S. army as the B-17 and officially designated Fortress in the R.A.F., the first model of this Boeing bomber in operational service in Europe proved under-armed and could carry only 12,800 lb. of bombs. Later types, the B-17E, F, and G, formed the backbone of American bomber strength, especially in mass daylight raids on Germany. Improvements included an armament of at least twelve 5-in. machine-guns, and a standard bomb-load was 6,000 lb. The four engines were of the 1,200-h.p. Wright Cyclone type; wing span was 103 ft. 9 ins., length 74 ft. 9 ins. From the same designers came the much larger Superfortress and later the Stratofortress.

Flying Fox. Erroneous name for the fruit bat, of the genus *Pteropus*. It is due to the fact that



Flying Fox: the Malayan species

the head slightly resembles that of a fox. Unlike other bats, which it greatly surpasses in size, it feeds entirely on flowers and fruit. It is found in S. Asia, the E. Indies, Madagascar, Australia, and some of the Pacific islands. The largest species, that of Malaya, *Pteropus edulis*, measures over 5 ft. between

the tips of the wings, and is considered a great delicacy. The fruit growers of Australia suffer much from its depredations. The name is sometimes wrongly given to the Flying Phalanger (*q.v.*). See Bat.

Flying Lemur (*Galeopithecus*). Popular name for the cobago of Malaya, only member of the order Dermoptera. The loose skin along the sides of the body and neck spreads into a kind of parachute when the animal launches itself into the air, enabling it to cover at one bound as much as 70 yds. from tree to tree. It feeds on leaves.

Flying Officer. Commissioned rank in the R.A.F. above that of pilot officer and immediately below

that of flight lieutenant. It replaced the rank of observer officer in 1930. A flying officer's rank is indicated by a single ring, slightly wider than that of a pilot officer, on the sleeve or epaulette.

Flying Phalanger (*Petaurus*). Small squirrel-like opossum, of which there are three species, found only in Australia and New Guinea. It is able to take long gliding leaps through the trees, partly supported by a membranous extension of skin. It feeds upon insects, fruit, and blossoms.

Flying Speed. Normal speed which an aeroplane must maintain in order to remain in the air, or the actual air speed of a machine necessary for its support in the air. This must not be confused with the apparent or ground speed of the machine. See Airspeed.

Flying Squad. Mobile section of a police force equipped with fast cars for dealing with smash-and-grab thieves and sudden outbreaks of crime. The first flying squad was established by the London metropolitan police in 1919, and similar organizations were adopted throughout Great Britain. Flying squad cars, which bear no outward indication of their police duties, are equipped with concealed radio which enables them to keep in constant touch with headquarters.

At New Scotland Yard there is a plotting table which shows the position of every car on patrol. When a crime is reported to the control room, the time and place of its commission, with any available details of the criminal, are transmitted by radio to the squad car nearest to the scene. With the development of television, experiments have been made in the transmission to cars of photographs of wanted criminals. The picture appears on a small panel on the dashboard and remains there until another message is transmitted. Autogiros have been introduced into the flying squad,



Flying Lemur, *Galeopithecus*, with skin distended for gliding

primarily to assist in traffic control, but also to direct converging squad cars.

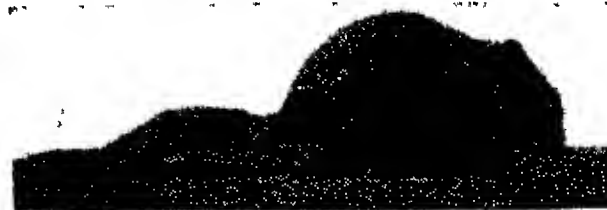
Flying Squid (*Ommastrephes sagittatus*). Species of squid or cuttle fish.



Flying Squid. A cuttle fish which springs out of the water

Long and narrow in shape, it is common in the open seas, and forms an important part of the food of the sperm whale. It is often called the sea arrow, from its habit of darting backwards out of the water for a considerable height.

Flying Squirrel (*Pteromys*). Name given to a number of species found in N. America, Asia, E. Europe, and Africa, and not closely related. Members of this group are able to simulate flying by the ex-



Flying Squirrel of North America. It is nocturnal in habit

tension of the loose, lateral folds of their skin. All are nocturnal in habit. See Squirrel.

Flying Training Command. Organization established by the R.A.F. in May, 1940, for the training of pilots, observers, and air-gunners. The command was in six groups, one of which dealt with initial training for all categories of air crew; two with elementary flying training; two with service flying training; and the sixth included the observer, bombing, and gunnery schools. Central flying schools, from which R.A.F. flying instructors must qualify, were also in this command. Men passing out of the Flying Training Command were posted to operational training units, where bomber crews were formed to train as teams in aircraft actually on operational service. In 1947 the command was equipped with Boulton Paul jet-propelled training aircraft.

Flying Wing. Aircraft consisting of a single triangular wing. The fuselage is integral with the wing and does not normally project beyond the leading and trailing edges. The aircraft has no tail assembly of fin and rudders, small vertical surfaces being mounted at

each wing tip. Aircraft of this type can be powered by either piston engines or jet turbines. During the Second Great War the American Northrop company tried an experimental all-wing aircraft known as the N.I.M. In Great Britain Armstrong Whitworth designed a commercial flying wing to carry a payload of 130,000 lb. at 400 m.p.h. The main advantage of such aircraft is the reduction of structural weight and air resistance. From the flying wing aircraft developed the delta wing, so-called because the wing shape approximated to that of the Greek letter Δ (delta). An example of delta wing aircraft is the Fairey Delta 2 experimental fighter, which in 1956 set up a world speed record of 1,132 m.p.h.

Flysch. Geological formation. It consists of enormously thick series of sandstones and shales, occurring in the Alps, Apennines, Carpathians, Istria, Dalmatia, Bosnia, Greece, Asiatic Turkey, Caucasus, stretching through S. Asia and still farther East. Their exact age is uncertain, but varies from lower Cretaceous to middle Tertiary. They represent a phase of deposition of sediments of long duration and great geographical extent.

Flywheel. In engineering a rimmed wheel mounted on a shaft which is subjected to, or has to exert, a turning effort more or less intermittently. The turning moment (or torque) of an engine on the driven shaft varies during a revolution, the variation depending upon the number and arrangement of cylinders and cranks. If the resisting moment due to the work being done by the driven member is constant, the speed will increase while the driving torque is in excess of the mean, and will decrease while this torque is below the mean. The fluctuation of speed during a revolution due to an increase or decrease of torque decreases with increase of inertia of the rotating parts and can be reduced to any desired small amount by the provision of a flywheel having sufficiently large inertia. This inertia is increased by either increasing the mean diameter of the rim or increasing the weight of the rim, or by both methods. Work is done by the wheel when its speed is reduced, and additional work is stored in the wheel when its speed is increased.

The effect of a flywheel in reducing speed fluctuations is greater at high revolution speeds than at

low speeds; it varies with the square of the revolutions. Thus a high speed petrol engine requires a very much lighter flywheel than, say, a slow speed gas engine of the same power to keep the speed fluctuation low. In some cases (e.g. in marine engines), the inertia of the rotating parts of the engine added to that of the driven member (propeller and shaft) supplies all the flywheel effect required. In some motor vehicles a hydraulic clutch, acting on the principle of the Froude dynamometer, is incorporated in the flywheel, which is known as a fluid flywheel.

Foal. Young of the horse and of the ass, of either sex. The term colt has come to be appropriated to the young male animal; filly, a diminutive of foal, to the young female, but formerly the distinction was less rigid. The word is connected ultimately with Gr. *pólos*, foal, and Lat. *pullus*, young animal.

Foch, FERDINAND (1851-1929). French soldier. He was born at Tarbes, Oct. 2, 1851, and educated at St. Étienne, at the Collège St. Michel, under Jesuit direction, and at the Collège de St. Clément at Metz. From early years his favourite reading.



F. Foch

Having enlisted during, but seen no service in, the Franco-Prussian war of 1870, he returned to Metz, but soon entered the engineering and artillery establishment at Fontainebleau. In 1874 he was attached to the 42nd regt. of artillery at Tarbes. Two years later he took a course at a cavalry school at Saumur, and in 1878 became captain of the 10th regt. of artillery. He was picked for the school of war in 1885, and on leaving was appointed to a divisional staff. He was transferred to the general staff in 1894, and later became professor of military history, strategy, and applied tactics at the École Supérieure de Guerre. His lectures there brought him some fame, the bulk of them being collected in two books, *The Conduct of War* and *The Principles of War* (the latter trans. H. Belloc, 1918). Their general argument is that though the art of war is simple, few can acquire it, as its execution demands the highest will, purpose, and strength in a commander who can impart them to his soldiers.

In 1901 Foch was sent to command a regiment. It has been said that his religious beliefs, and the fact that a younger brother was a Jesuit, were the causes of this apparent setback. However, in 1903 he became full colonel, in 1905 chief of staff to the 5th army corps, and in 1907 brigadier-general with a position on the general staff. Clemenceau then offered him the command of the École de Guerre, where he spent an invaluable 4½ years, greatly admired by his pupils. In 1911 he became general of division, in 1912 of the 8th army corps, and in 1913 took command of the 20th army corps at Nancy.

On four critical occasions during the earlier part of the First Great War Foch proved his principles in action: in the abortive French offensive and subsequent defence of Nancy, Aug., 1914; on the Marne, Sept., 1914; with the British at Ypres, Oct., 1914; and on the British right flank on the Somme, July, 1916. It was from the Marne, while in command of the new 9th army which he had formed with great speed and thoroughness, that he sent his famous dispatch: "I am heavily pressed on my right; my centre is giving way; I cannot redistribute my forces. The situation is excellent; I am attacking."

On Sept. 30, 1916, Foch reached the age limit, was awarded the *médaille militaire*, and withdrawn from any particular command, though retained on the active list. In Dec., 1916, he became director of a bureau for the study of inter-Allied problems, and pressed for the creation of a strong Allied reserve. Early in 1918 it was decided to place him in command of such a reserve. Then, as the result of the critical German offensive of March 21, which drove a wedge between French and British, a momentous inter-Allied conference was held at Doullens (March 26), at which Foch was appointed generalissimo of all Allied forces fighting on the western front.

After checking the final German offensive between Reims and Soissons, he launched his decisive counter-offensive on the Marne on July 18, which ceased only with the German demand for an armistice. On Aug. 6 he was made marshal of France. The first German request was made on Oct. 3. Foch communicated with the German plenipotentiaries by radio, met them at Rethondes on Nov. 8, and ensured their acceptance of conditions which he had been

engaged in drawing up for some weeks. On Nov. 11, the day the armistice came into operation, marking the defeat of Germany, the French deputies unanimously voted that Foch had "deserved well of his country."

In Paris on July 14, 1919, he led his victorious troops through the newly reopened gates of the Arc de Triomphe de l'Étoile, and on July 19 rode with Haig at the head of the victory parade in London. Foch never lost his essential calm and poise, which gave to all who met him the sense of a man possessing an inexhaustible reserve of confidence, founded on force of will and clearness of intellect in effective combination. He died on March 20, 1929, and was buried in the Invalides, Paris.

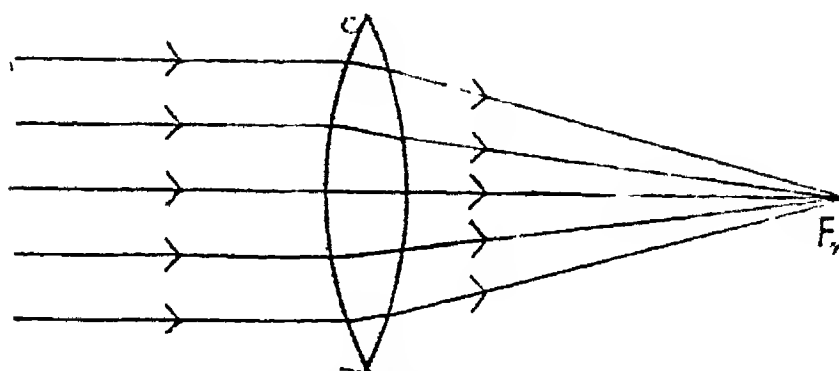
His memoirs were published in an English trans., 1931. There are lives by Sir G. Aston, 1929; B. H. Liddell Hart, 1931. Consult also Foch Talks, Cmdt. Bugnet, 1929.

Focke-Wulf. German aircraft manufacturers, with main works at Bremen. Apart from an experimental helicopter, Focke-Wulf attracted little attention until the Second Great War. Two of their products then achieved world fame. The four-engine Fw 200, already in use as a commercial transport and named Condor, was militarised as the Kurier, and, with a range of over 2,300 m. and usually armed with two 20-mm. cannon in addition to machine-guns and $1\frac{1}{2}$ tons of bombs, was used for Atlantic reconnaissance and anti-convoy attack. Wingspan, 108 ft.; engines B.M.W. or Bramo radials.

The Fw 190, introduced in 1942, became the most successful single-seat fighter of the Luftwaffe. Its compact design (span 34 ft., length 29 ft.) and all-round performance owed much to the then new 1,600-h.p. B.M.W. 801 radial engine. The armament of four 20-mm. cannon and two machine-guns was at that time outstanding. Later the Fw 190 was powered by a 1,700-h.p. Junkers in-line unit—the so-called "long-nosed" Fw 190. The final Focke-Wulf fighter to reach the squadrons was the Ta 152, a completely fresh design capable of over 460 m.p.h. This had an exceptional span of wing to aid high-altitude interception. Long-range tanks, bombs, or rockets could be carried on all these types. See Aeroplane illus. p. 132.

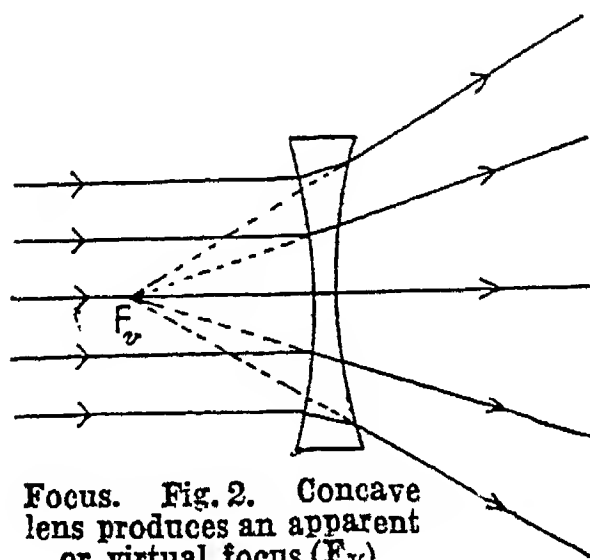
Focus. The point at which converging rays meet. A virtual focus is the point from which diverging rays are considered to be directed.

With light rays the two cases are respectively illustrated by means of convex and concave lenses.



Focus. Fig. 1. Convex lens causes light rays to be brought to a real focus (F_r)

Fig. 1 shows parallel rays of light striking a convex lens and being brought to a real focus F_r , while Fig. 2 indicates that a concave lens causes the incident rays to



Focus. Fig. 2. Concave lens produces an apparent or virtual focus (F_v)

diverge so that they appear to come from the virtual focus F_v . The distance from the focus (or focal point) to the lens is known as the focal length.

In mathematics a focus is a point from which, if lines are drawn to any points on a curve, the lengths of these lines conform to some law. In medicine, it is a part of the body where a disease originates or is most active. In photography, and in the use of such instruments as the micro-

scope and telescope, focusing is the operation by which the lens is so positioned as to give the maximum crispness of detail and definition. The adjustment may be made visually or in conformation to a predetermined scale of distances. See Camera: Lens; Photography.

Fodder. Name applied to the bulky part of the food of stock. Coarse fodder crops,

also known as forage, include cereal straws, meadow hay, seeds, and clover hay, all characterised by a high fibre content but useful in promoting a feeling of repletion in the animal. They are distinguished from the green fodders such as pasture grass, lucerne, sainfoin, clover, and green maize, which have a great deal of leafage and are often given in a green condition; lucerne, sainfoin, and clover also making excellent hay. Succulent fodders include mangolds, turnips, swedes, carrots, parsnips, and kohlrabi; in addition to the leaves, the roots of some of these crops are valued for the dry matter they contain, which varies from 8 to 9 p.c. in turnips to 15 p.c. in mangolds and 25 p.c. in sugar beet. About two-thirds of the dry matter exists in the form of readily assimilated sugar.

Foetus (Lat., offspring). Biological term meaning the young of an animal, usually with reference to a visible embryo either in an egg or within the womb. The term is applied to that stage of the development of the embryo after its various parts can be distinguished up to the period of birth. See Embryology.

FOG: OBSCURITY IN THE ATMOSPHERE

A. J. Drummond, F.R.Met.S., and David Le Roi

An explanation of the causes, nature, and varieties of fog is followed by a description of fog signals; also of methods of air navigation in fog and of fog dispersal

Obscurity in the surface layers of the atmosphere due to the condensation of water vapour as surface clouds, or to smoke held in suspension in the air, constitutes fog. Meteorologically, the term is limited to conditions when objects as near as one km. are not visible. In country districts fogs result purely through condensation, in industrial areas smoky atmospheres produce the well-known yellowish-black fogs, and in desert regions dust fogs occur. High fogs, where condensation takes place one or two thousand feet above

the surface in a layer containing a great amount of smoke, are observed over large cities, particularly London. In such instances it may be as black as night overhead without significant reduction in the horizontal visibility.

Radiation fogs, formed by the cooling of the surface layers of air below the dew point, although generally of short duration may be extremely dense, especially in river valleys and grassy hollows. When the sun's heat is sufficiently powerful this type of fog thins out rapidly. Another kind of fog forms

when warm air flows over cold ground, or when mixing of two currents of air at different temperatures occur. Thus, off Newfoundland, the warm air over the Gulf Stream produces dense fogs when it meets the cold air over the Labrador Current. Land fogs are formed mostly during winter months; sea fogs are characteristic of spring and summer. Although the upper boundaries of fogs are often not sharply defined and may continue upwards as clouds, the height is usually less than 1,000 ft. Mist is fog in a lesser degree.

NAVIGATION IN FOG. Fog signals of the type used at sea and on board ship are purely warning devices, not intended to enable shipping to continue under way; in crowded waterways shipping normally stops in heavy fog. There are, however, devices to allow ships to navigate in bad visibility. Many large liners are equipped with a cathode-ray oscillograph. Vessels moving in a fog area automatically transmit every 15 secs. on a wavelength of 600 metres short signals lasting approximately 1/100th of a second; these signals are picked up by all similarly equipped ships and appear as lines on the oscillograph screen. According to the direction of the lines on the screen protractor, it is possible for the receiving vessels to establish the relative course and bearings of all transmitting ships within range.

Another device is the fog camera, developed during the First Great War. Fitted to the ship's bridge, this camera automatically takes photographs every minute by infra-red rays which penetrate fog and smoke. The films are automatically developed and fixed in 50 secs., and by pressing a button at the side of the camera the officer of the watch instantly illuminates the latest negative. The camera has disclosed objects 6 m. distant when visibility was virtually nil. It is not so effective at night, when it will pick up only such objects as ships, lighthouses, and buoys equipped with apparatus for transmitting infra-red ray beams.

Radio beacons and direction finding are described under their appropriate headings. Sonic fog signals are of little use to aircraft, owing to the excessive noise of engine and propeller, but almost all the radio devices used for navigating in bad visibility at sea have been applied to air transport. The Lorenz Beacon (*q.v.*) and the

Loran systems have been specially developed.

The increasingly high speed of aircraft, which has steadily reduced the margin of visibility, even in clear weather, has equally steadily increased the risks of navigation in fog, and Feb. 1, 1938, the Air ministry brought into practice a system of one-way "roads" to govern flying in fog. Known as the directional system, it operates when horizontal visibility is less than 1,100 yds., and provides that machines flying in different directions shall fly at different altitudes.

Over the area covered by air routes between Great Britain and the Continent, the whole air space above 19,000 ft. is reserved for regular liners; while over the rest of England, Scotland, and N. Ireland the scheme operates above an altitude of 3,300 ft. Above that height the air space is divided into four horizontal zones; 3,300–6,600 ft., 7,000–10,600 ft., 11,000–14,600 ft., and 15,000–18,600 ft. The zones are thus separated from one another by a margin of 400 ft., and each zone is divided into 12 layers, in one of which the aircraft must fly during fog according to the magnetic bearing of its pilot's course. (*See Navigation; Radio.*)

FOG SIGNALS. Signals of warning to traffic during fogs. The highest development of sonic devices for use when atmospheric conditions obscure normal visual signals has been achieved in the spheres of sea and rail transport. Board of Trade regulations require all vessels at anchor in fog to ring bells at one-minute intervals. Steamships under way sound sirens every minute; sailing ships may use horns or whistles. Audible warning to vessels moving in coastal waters in fog is given either by

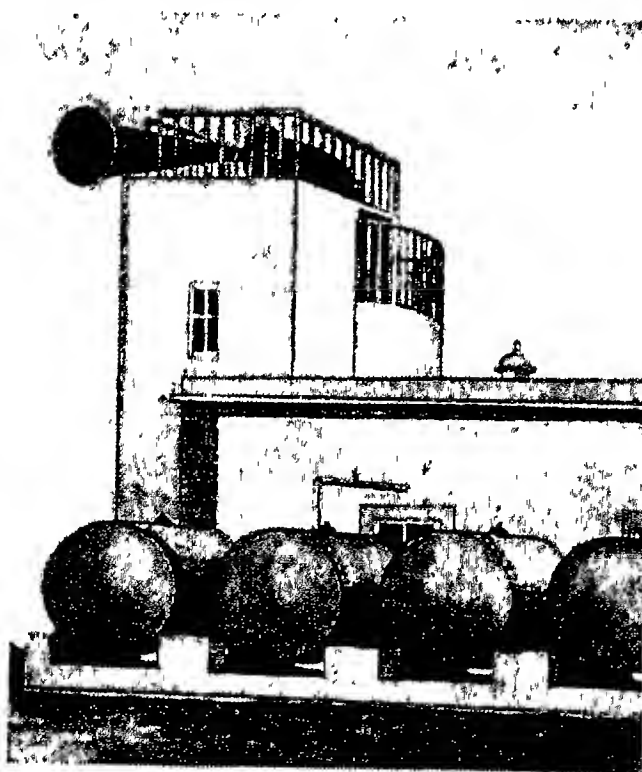
bells mounted on buoys, or by fog-horns operated in conjunction with lighthouses.

Modern fog-horns on the coast are mechanically operated, the sonic portion consisting of two cylinders, one of which moves over the other. Both cylinders have a number of perforations which during rotation periodically coincide, so that the upper holes come over the lower ones. When compressed air or steam is forced through the holes of the upper cylinder at the moment when the holes on the lower cylinder coincide, the air is set in rapid vibration. The result is a loud, deep note which is concentrated and sent in the required direction by a large horn or bell-mouthed tube. The moving parts of the fog-horn are driven either by electric motor or by compressed air. The largest fog-horn of this type is at the Cumbræ lighthouse in the Firth of Clyde, which in favourable circumstances can be heard for 20 miles. The Caskets fog-horn consists of mushroom trumpets attached to sirens and blown by compressed air, which distribute the sound all round the horizon. In the U.S.A. attempts have been made to guide shipping by means of eight fog-horns fixed radially, short and long blasts of Morse being sounded according to the compass direction.

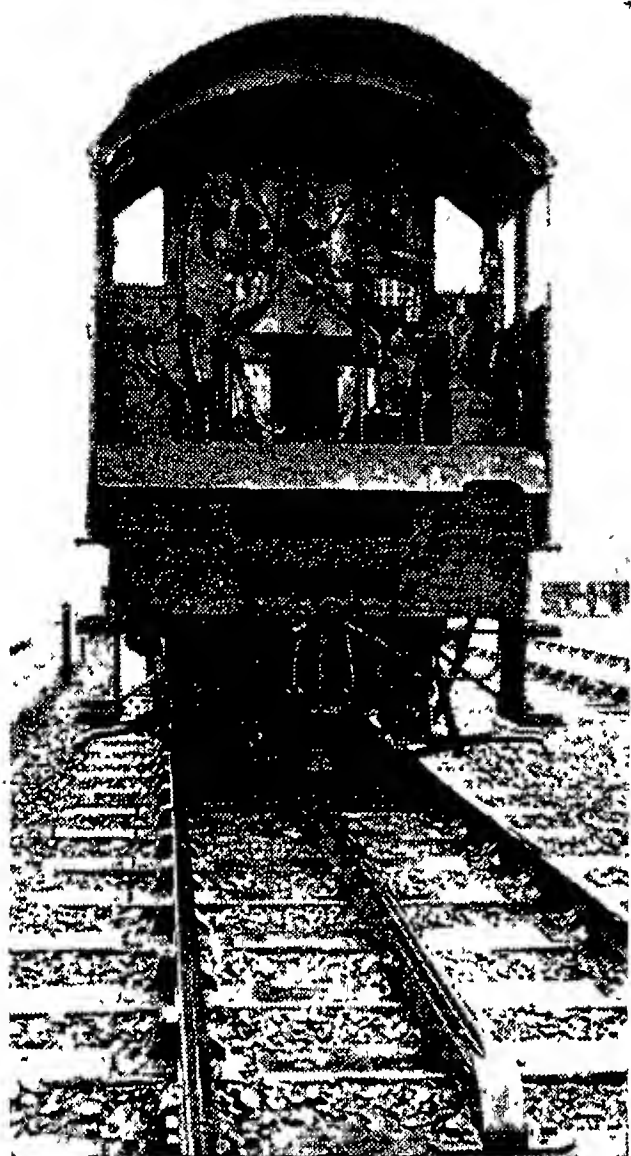
The prototype of the coastal fog signal was the bell used in medieval days, as on the Inchcape Rock (*q.v.*). Bell and whistle buoys (*see Buoy*) are still common, particularly for giving warning of shoals, pierheads, and breakwaters. The bells are operated by the movement of the sea, clockwork, or electric motor, and some can be heard for 14 m. On certain lighthouses, such as Eddystone (*q.v.*), use is made of explosive signals detonated electrically at fixed intervals. On the Clyde are unattended acetylene fog-guns which are switched on and off by a radio transmitter on Gourock pier.

Soundless zones are interposed between near and distant audible zones under certain atmospheric conditions. Hence the utility of submarine bells, placed on the sea floor, buoys, and light vessels, and audible to ships fitted with receiving apparatus. The sound can be picked up from 10 m. away. A similar apparatus is sometimes used with submarine cables.

When fog obscures rly. signals, detonators are placed on the line by fogmen stationed at the ordinary visual signals. The detonator consists of two tin cups fitting



Fog. Fog-horn on Little Cumbræ island, in the Firth of Clyde; it is operated by compressed air from the cylinders shown



Fog. Automatic railway fog signal, showing engine contact shoe on ramp

tightly together and enclosing a star-shaped piece of lead in which are fixed five percussion caps, the remainder of the space inside the cups being filled with black powder. The detonators are attached to the rail head by lead clips and explode when the wheels of an engine passes over them. In some sections of the line, particularly at stations and junctions, detonator-laying machines are installed; these are operated from the nearest signal box.

Another rly. fog signal, the audible searchlight, works as follows. About a quarter of a mile in front of the "distant" signal a 40-ft. ramp is placed between the rails and connected electrically with a switchboard in the signal box. Beneath the rly. engine is a shoe, which engages with the ramp, closing an electrical circuit. If the distant signal is set at danger when shoe and ramp make contact, a siren sounds in the locomotive cab. At the same time, the electric impulse conveyed through the ramp opens a valve in the vacuum-brake pipe and automatically brings the train to a standstill. If the distant signal is off when shoe and ramp engage, the switchboard in the signal-box rings a bell in the engine, indicating that the line is clear.

Most large signal-boxes are equipped with a train movement and track diagram to facilitate the signalling of trains in fog.

By electric circuits in the permanent way, which are closed by the train's passing over them, a chart of the tracks signalled from the box is illuminated to warn the signalman of all moving and stationary trains.

FOG DISPERSAL. Efforts have been made to accelerate by artificial means the condensation of moisture as it comes into contact with the atmospheric particles and so cause fog to fall as rain. Electric precipitation and the sprinkling of electrically charged sand and water from aircraft flying above the fog have been tried, but the clearance is only temporary. In 1938 some success attended experiments conducted by the Massachusetts Institute of Technology. A system of perforated pipes was erected 20 ft. from the ground and sprayed a chemical mixture having the property of dissolving the minute particles of matter constituting fog. At a small aerodrome a dense fog was cleared in five minutes; but dispersal was only temporary. Attempts have been made by the British Association to blow away fog by bombarding the atmosphere with cannon; but the process is unreliable.

Sir Oliver Lodge tried electric dispersal of fog and successfully cleared small areas irrespective of meteorological conditions. Current at a pressure of 400,000 volts was discharged into the atmosphere from a series of high masts.

In 1936 the Air ministry sponsored experiments in dispersal by means of super-heating from radial lamps. The second temperature, or layer of cold air over the warmer, is negated and creates over the aerodrome a pocket of visibility in which aircraft can land. Radial heating has reduced fog up to 40 p.c., but the process is costly.

The high accident rate and the large number of potential flying hours lost through fog early in the Second Great War led to the establishment of the Fog Investigation Dispersal Operation, popularly



Fog. Flames of high pressure "Fido" system burning away fog from the runways of an airfield

known as Fido from its initials. This succeeded in getting rid of fog in bulk by artificial heating of the air. Pipes, through which petrol was pumped at high pressure, enclosed the airfield in a rectangle. At intervals in the pipes burners threw ignited petrol in a flame 2 ft. high.

Initial trials were made in Hampshire on Nov. 4, 1942, when a dense fog was cleared by petrol burners in an area of 200 sq. yds. to a height of 80 ft. The first full-scale test was held at Graveley,

Hunts, a runway 1,300 yds. long by 150 ft. wide being cleared of fog to a height of 100 ft. Fido was used operationally on Nov. 19, 1943, when four Halifax bombers landed in England, after an attack on the Ruhr, in visibility of less than 100 yds. By May, 1945, 2,500 Allied aircraft had been safely brought to ground in thick



Fog. Double fog detonators on railway line, operated by the signal above being at "danger"

fog. Rundstedt's Ardennes offensive of Dec., 1944, was halted largely by the weight of Allied air attack by bombers able to take off and land from fog-bound airfields. Fido consumed 70,000 gallons of petrol an hour, and because of its excessive cost was not easily adaptable to civilian use.

Fogazzaro, ANTONI (1842-1911). Italian poet and novelist. He was born at Vicenza, March 25, 1842. His first poems, 1863, were followed by a poetic romance, *Miranda*, 1874, and a volume of lyrics, *Valsolda*, 1876, which established his reputation as a poet. These were succeeded by the stories, *Malombra*, 1882, and *Daniele Cortis*, 1885. In 1888 came his first considerable success, the idyllic *Mistero del Poeta*; then the notable trilogy, *Piccolo Mondo Antico*, 1895; *Piccolo Mondo Moderno*, 1901; and *Il Santo* (The Saint), 1906; the last of which, his most famous work, was translated into most European languages. A staunch Roman Catholic, Fogazzaro sought to reconcile the theory of evolution with the teaching of his church; he has been described as Italy's modern poet of hope and faith. He died March 7, 1911. A *Life of Fogazzaro* by T. Gallarati-Scotti appeared in 1922.

Fog-bow. Rainbow of about 40° in arc with a broad white band in place of the more usual middle green-blue. The outer edge appears reddish and the inner faintly violet. It is observed during foggy weather, hence the name. The white band results from overlapping of the refraction colours, due to the smallness of the water drops present in fog. See *Rainbow*.

Fog Crystal. Phenomenon observable during fog and frost. Fog crystals are usually formed by particles of ice on surfaces in a fog, in frosty weather, as the fog is driven over those surfaces. These crystals, most common in hilly districts, are feathery in appearance, often reach several feet in thickness, and form with great rapidity in favourable conditions.

Foggia. A province of S.E. Italy, formerly known as *Capitanata*. In Apulia, bounded N. and E. by the Adriatic Sea, it has an area of 2,683 sq. m. Mountainous in the N.E. and W., it has in the central part a fertile plain. The coast is low and flat, and the climate hot and dry. There are numerous rivers, the chief of which is the *Candelaro*, with many tributaries. The lakes of *Lesina* and *Varano* lie in the N. of the

prov., and the *Lake di Salpi* in the S.E. The highest point is *Monte Calvo*, 3,460 ft. Vast flocks of sheep are pastured on the plain. Pop. (1951) 648,179. *Pron.* *foj-ya*.

Foggia. City of Italy, capital of the prov of Foggia. It stands in the centre of the Apulian plain, 78 m. E.N.E. of Naples, and 20 m. S.W. of Manfredonia, a junction of the coast rly. and the lines to Benevento and Potenza. The 12th century Gothic cathedral was partly destroyed by an earthquake in 1731, and rebuilt. An important fair is held every May for the sale of sheep, wool, corn, capers, and cheese. An ancient city, Foggia was a favourite residence of the emperor Frederick II, whose English wife, the daughter of King John, died here. Three miles N. of the city are traces of the ancient town of Arpi, or Argyripa, reputed to have been founded by the great hero Diomedes. Pop. (1951) 98,122.

During the Second Great War, Foggia became important as a centre of air activity. With its 13 airfields, it was captured from the Germans on Sept. 27, 1943, by a mobile column of the Allied 8th army. It became the base of the U.S. 15th A.A.F., which raided S. German, Austrian, Hungarian, and N. Italian targets from here.

Fogo (Port., fire). Volcanic island of the Cape Verde archipelago. Circular in shape, and mountainous in character, it has an area of about 190 sq. m. The loftiest point, the *Pico do Lano*, nearly 10,000 ft., has often been in eruption, notably in 1847, when it caused immense damage. Fertile in the N., where coffee, sugar, maize, and fruit are produced, Fogo is almost barren in the S. The chief town and port is *São Filipe*, or *Nostra Senhora do Luz*—Our Lady of Light.

There is another island of this name off the N.E. coast of Newfoundland in lat. 49° 40' N. and long. 54° 10' W.

Föhn (Ger.). The warm dry southerly wind which blows down the leeward slopes of Alpine valleys. The rise necessary to cross the ranges dynamically cools the air, producing rainfall in the mountains. On descending the other side the air, which has lost considerable moisture, is heated by compression and thus reaches the villages as a warm, drying wind. One explanation for the descent of the warm air into valleys already filled with cold air is that the latter is removed by mixing due to turbulence.

Another reason put forward is that the cold air gradually drains away, drawing the warm air downwards into the valley.

This wind in a few hours clears away more snow than many days of bright sunshine, and uncovers the upland pastures. In some valleys the early sowings are entirely dependent upon this wind, whilst in others it is relied upon to ripen the grapes in autumn. Strictly the term should not be used of a wind, but merely of the effect of descent upon a wind. The föhn effect can be recognized in most mountainous areas in temperate latitudes. See *Wind*.

Föhr. Island in the North Sea, one of the N. Frisian group, belonging to Germany. It lies off the W. coast of Slesvig, opposite *Dagebüll* on the mainland, and has an area of 32 sq. m. Largely marshland, protected in the N. by dykes, it is elsewhere elevated and timbered, with fertile soil. The inhabitants live by wild-fowling, fishing, and catering for visitors. The chief town is *Wyk*, a resort on the E. coast. Pop. 7,000.

Foie-gras (Fr., fat liver). Livers of geese enlarged abnormally by keeping the birds in a heated compartment, and made into the paste known as *pâté de foie-gras*. The *Strasbourg* variety is well known.

Foil. Weapon used in fencing. It is a very slender, four-sided steel blade, with a handguard to the hilt, and a button on the tip, the object of the fencer being to touch some part of his opponent's body with that button. See *Fencing*.

Foil. In metallurgy, a thin form of metal, which may be said to occupy a position intermediate between a leaf, e.g. gold leaf, and sheet metal. A very thin tinfoil is made for chemical and electrical uses, and for backing mirrors; tinsel is a rather thicker foil much used for theatrical purposes; Dutch foil is specially prepared for the backing of artificial gems, to give brilliance; it is coloured by Prussian blue and other pig-



Foil, fencing weapon, and method of holding

ments. Gold foil has been used by dentists for stopping teeth.

Ordinary commercial tinfoil, largely used for wrapping tobacco, chocolates, other sweets, and toilet articles, is made of lead coated on one or both sides with tin, the two metals being rolled together so that they become quite inseparable. The tin surface may have merely an infinitesimal thickness, yet it is sufficient to prevent contact with lead. The latter metal contributes the substance and the flexibility to the foil; the tin, much the more expensive metal, provides the non-poisonous surface.

Aluminium, with its light weight, makes a thin foil as an alternative to that of lead. A beautiful variegated foil, which we owe to the Japanese, is made by soldering together by their edges 30 or 40 thin sheets of gold, silver, copper, and various alloys; punching or cutting a pattern through these sheets, the holes going to varying depths, then rolling down the "book" of sheets to the desired thinness. The holes disappear in the finished product.

Foix. Town of France, capital of the dept. of Ariège. It stands between the rivers Ariège and Arget, 46 m. S. of Toulouse. Its interest is mainly historical, as the capital of the county of Foix. The powerful counts of Foix lived in its castle, of which there are some remains on the rock, round which the older part of the town clusters. The church of S. Volusien dates from the 14th century. There are small industries, and the town is the commercial and administrative centre for a large district. Pop. (1954) 7,632.

The county of Foix varied in extent from time to time. It was ruled by its counts, vassals of the king of France, and was a province of France before the Revolution. *Pron.* fwah.

Fokine, MIKHAIL (1880-1942). Russian dancer and choreographer. He was born in St. Petersburg (Leningrad) and began his studies as a dancer under Karsavina's father at the imperial school of ballet. He developed his ideas for the reform of conventional ballet, and a meeting with Benois and Diaghilev (*q.v.*) proved eventful, for during the famous season of Russian ballet in Paris in 1909 he produced *Les Sylphides*, *Le Pavillon d'Armide*, *Cléopâtre*, and *Prince Igor*. Among his later ballets were *L'Oiseau de Feu*, *Scheherazade*, *Le Spectre de la Rose*, *Le Coq d'Or*, *Petrouchka* (considered his masterpiece), and

Paganini. For Pavlova he devised *Le Cygne*. He died in New York, Aug. 23, 1942. *See* Ballet; *consult also* M. F. and his Ballets, C. W. Beaumont, 1935.

Fokker, ANTHONY HERMAN GERARD (1890-1939). A Dutch aeronautical engineer. He was born at Kediri, Java, April 6, 1890, and educated at Haarlem, starting his aeronautical career at 20. Fokker became well known after his success in a competition for military aircraft at St. Petersburg. Before the First Great War his designs had been offered unsuccessfully to the British and Italian governments. They were accepted by Germany, and his first biplanes and triplanes gained a great reputation, especially after they had been fitted with an interruptor gear that permitted a machine-gun to be fired through the propeller. After the war he established aircraft factories in the Netherlands, Spain, and New Jersey. Fokker went to the U.S.A., where he died Dec. 23, 1939. His autobiography, *Flying Dutchman*, was published in 1931. *See* Controlled Gun; also *Aeroplane illus.* p. 134.

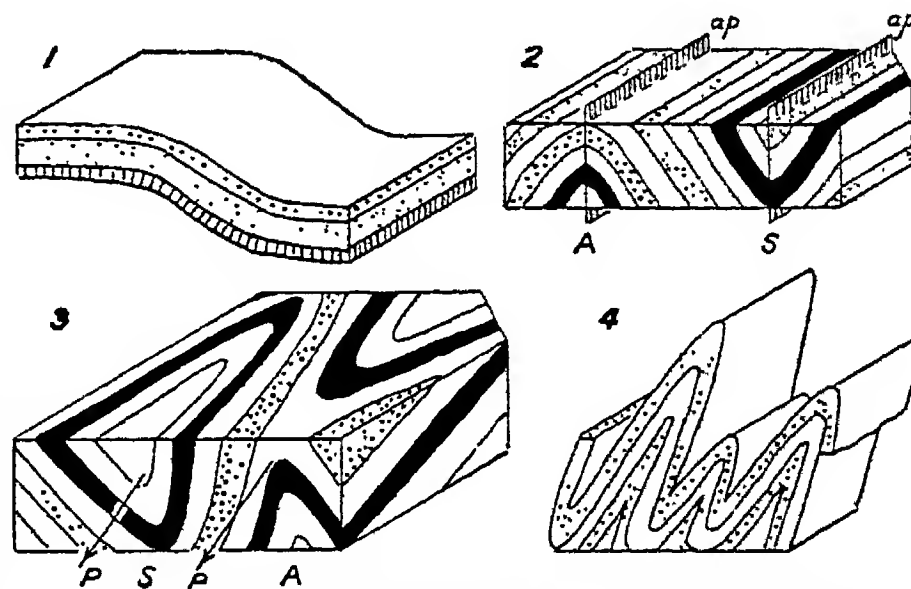
Fold. In geology, the warping or bending of strata which were originally deposited in more or less horizontal layers. Folds are caused by earth movements and are usually associated with compressional stresses acting in the crust. A step-like inclination of strata in one direction is referred to as a monocline. The up-arching or down-warping of beds produces anticlines or synclines respectively. These are elongated, like folds formed in a pushed tablecloth, normal to the direction of greatest compression, and in their simplest form can be likened to a sheet of corrugated iron.

Individual folds tend to die out along their lengths; hence their crests or troughs are rarely horizontal. Such folds which have a slope along their lengths are said to pitch or plunge. Intense compression of the beds leads to the asymmetrical development of folds in which one limb is steeper than the other. The folds are then inclined, and with further movement may be pushed further over to

become overturned or even recumbent. Where a fold has been so squeezed that its limbs are more or less parallel it is isoclinal. Dome- and basin-shaped fold structures can be formed as well as the more common elongated types. The outward dip of strata around a dome is termed *quaquaversal*; the inward dip around a basin is *centroclinal*. Folds are of the greatest importance in the economic applications of geology. The formation of slate is usually associated with folding. Artesian water supply is often obtained from synclines, as in the broad basin-like structure of the Chalk below London.

Oil concentrations are commonly located at or near the crests of domes or anticlines.

Folding Machine. A machine primarily in use in printing to convert into sections the flat sheet of printed paper as it comes from the press. Before its adoption these flat sheets were folded by hand. Each class of machine varies in its action, but generally the folded sheets are automatically fed up to a side-gauge on the machine bed, and then brought to the correct position by an automatic device to ensure accurate folding. A descend-



Fold: in geology. 1. Monocline. 2. Upright anticline (A) and syncline (S) with vertical axial planes (ap). 3. Pitching folds, anticline (A) and syncline (S); direction of pitch (P) shown by arrows. 4. Tightly compressed folds becoming almost isoclinal

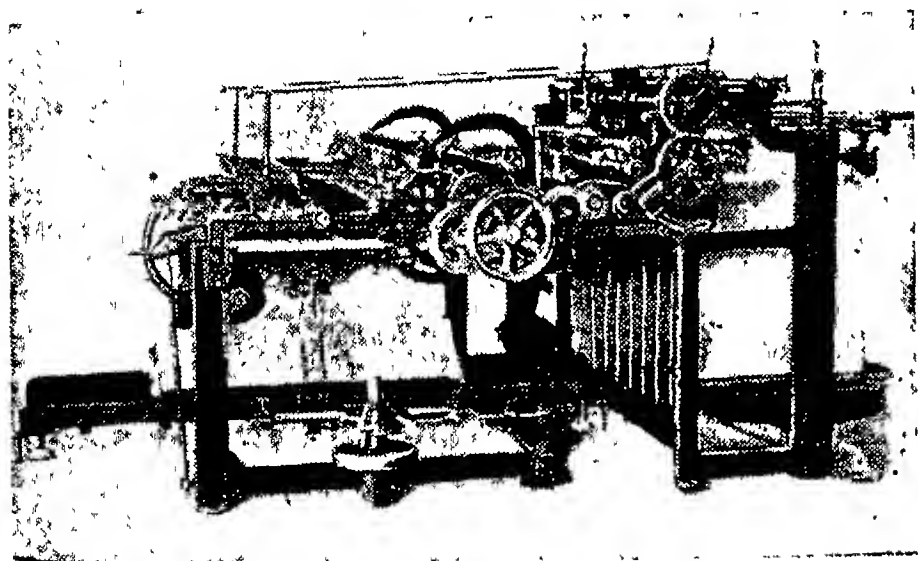
ing blade then presses the sheet between two revolving rollers through which the sheet passes, thus making the first fold. The sheet then travels to the second pair of rollers, set at right angles to the first pair, where a similar action is performed, and so on for each succeeding fold.

Some machines are made for parallel folding, *i.e.* folding the sheet over and over in the same direction by blades and rollers parallel with each other operating consecutively. Imagine the first fold down the centre of one way of the sheet and the second fold parallel with the first; we then have the

sheet the original length one way, and one-fourth the original length the other way; as this enters the delivery it is slit into sections.

In some folding machines the sheets are fed in automatically, folded, gathered, stabbed, and the covers glued on before delivery.

Newspapers are folded by means of an auxiliary part of the printing press. The endless web of paper travels over a V-shaped plate,



Folding machine. Double sixteen book-folding machine, constructed to fold a sheet into two lots of 16 pages, one lot inserted in the other, to make a section of 32 pages

forming the first fold or spine of the newspaper; the web continues its course (now in page size) until it reaches another section of the machine, the next fold being then accomplished by means of a turning blade attached to and rotating in a cylinder. There are many other types of folding machine.

Folger Shakespeare Library. Library and research institute in Washington, U.S.A. The library, which consists of about 250,000 volumes, was founded in 1930 (opened 1932) by Henry Clay Folger (1857-1930), president of a New York oil company, and his wife, and is administered by the trustees of Amherst College, where he was educated. Its Shakespeare collection includes 79 copies of the First Folio and 160 copies of the Quartos. It has an extensive collection of English books printed before 1640, and many original sources for the history of English and American drama. It owns a large collection of 16th- and 17th-century books gathered by Sir Leicester Harmsworth. As a research establishment it specialises in the study of English civilization in America before 1700. It has an exhibition gallery which is open to the public.

Foliation. In geology, a structure characteristic of metamorphic rocks, particularly of schists. It consists of the arrangement of the rock-material in more or less parallel, sometimes lenticular, and frequently undulating layers. Split-

ting usually takes place readily along these layers. See Rock.

Foligno (anc. Fulginium). City of Italy, in the prov. of Perugia. It stands in a beautiful valley, on the river Topino, 23 m. by rly. S.E. of Perugia, and is enclosed by medieval walls. It has a 12th-century cathedral, which has been modernised, several old palaces, and a picture gallery. There is trade in paper, leather, parchment, silk, and soap. An ancient city, Foligno was razed to the ground in the wars of the 13th century. Rebuilt, it was greatly damaged by earthquakes in 1813 and 1832. The cathedral and a palace were damaged and an oratory destroyed by bombs in the Second Great War. The Allies entered Foligno June 16, 1944, the Germans having already left. Pop. (1951) 43,970.

Folio (Lat. *folium*, leaf). In bibliography, a book of the largest size, the sheets of which are folded once into two leaves, making four pages. For convenience in binding, two or more sheets are inserted into each other. In all but modern books the watermark of the paper is seen in the centre of the page if the work is a folio; if in the middle of the inner margin, divided by the fold at the back of the book, with the chain lines horizontal, the book is a quarto (*q.v.*).

The word folio is applied to the numerical mark on each page of a printed work or each leaf of MS. It is used to indicate the number of words in a page of law writing, or report of parliamentary proceedings, to a case for holding music, and, in book-keeping, to the two facing pages of a ledger or account book containing respectively the creditor and debtor accounts. In 16th century English the word was used to mean "on a large scale." See Book; Paper, Sizes of.

Folk Dance. Term for any form of dance native to a people. Originating in religious custom and ritual ceremony, the native dance has continued as a folk dance among peoples long after the religious significance has died out. Many European folk dances are still linked with the old seasonal festivals of pre-Christian days. European folk dances may be roughly divided into two types: (1) ceremonial and ritual dances,

with magical purpose behind the ritual, which were performed by a select group of initiated men, and which retain their ceremonial character and their link with an old seasonal festival; (2) dances performed by the community as a whole, which gave rise to the various forms of social dance which have been the recreation of the people throughout history.

Ceremonial dances, often of a dramatic nature, symbolise fertility, the contest of life and death, and the rebirth of nature in spring. Fertility dances include the English morris or morrice; the Robin Hood games; the Staffordshire horn dance; the hobby horses; and these have their counterpart in Continental folk customs. Contest dances are performed by two opposing lines of dancers, dressed to show their difference in kind: the whites and the blacks, the reds and the blues, the uglies and the beautifuls. Rebirth dances are represented in England by the Northumbrian and Yorkshire variants of the sword dance, which is part of a popular drama, the folk play or mummer's play, with death and resurrection as the central theme. Common to all three forms of ceremonial dance is the practice of actors disguising themselves by masking or blacking their faces.

English Folk Dances

Social folk dances no doubt sprang from a festival of general celebration which followed the completion of the ritual dances. Many of the English kind are derived from the early forms of may-pole round; others from processional ceremonies, such as the furry dance of Helston. From the old rounds and long dances have grown other types of set dance, including the square of four couples. During three centuries a continual process of exchange of social dances between town and country has exercised influence on the style and manner of dancing. The true folk dance has always been characterised by a natural simplicity and a spontaneous gaiety. Lancers, quadrilles, etc., popular in the ball-room fifty years ago and imported into England from France, are not true folk dances but town versions of the older rustic square folk dance. Examples survive as true folk dances in country places in England and are widespread in America. English country dances that have been popular in town life have been preserved in printed collections since the Stuart days,

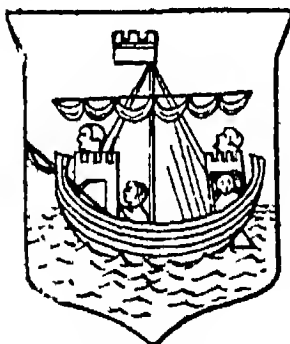
and it is therefore possible to follow their evolution to recent times.

The folk dance in Europe was in danger of dying out with the passing of the peasantry. Societies and organizations were founded in many countries to preserve and revive the folk dances as part of the national tradition.

The music of the folk dance is simple, melodious, and strongly rhythmic. The characteristic instruments used are the whistle, or pipe, and drum. In England this familiar combination, played by one man, was known as the whittle and dub, or pipe and tabor (*pron. tabber*). It is still found in association with the men's morris dances, but mostly it has been supplanted by the fiddle, and more recently by melodeon and accordion. The actual folk tunes used for dancing are variants of folk songs and popular songs of any time, modified by the musician to suit the particular dance. The country dance tunes used for social purposes in town life were of no great musical merit.

Douglas Kennedy

Folkestone. Borough and seaside resort of Kent, England. It stands on the English Channel, 71 m. S.E. of London. For its holiday visitors the many attractions include The Leas, a promenade of wide lawns over 1 m. long on the W. cliff, commanding a splendid view from 100 ft. high of the sea; Kingsnorth Gardens, Radnor Park, and a fine sports ground. There are tennis courts, golf links, bowling greens, and a racecourse near by. The bathing is good from the sands to the E. of the harbour,



Folkestone seal

while the wooded West cliff has some delightful winding paths. Between Folkestone and Dover lies the Warren, a rugged, natural basin with abundant wild life and vegetation. Pop. (1951) 45,203.

Folkestone is spaciouly laid out on high ground surrounding the harbour, with the fishing and shipping quarter in the valley, where narrow thoroughfares and old houses give a glimpse into the past. As a seaport Folkestone has been much improved during the 20th century, the harbour having been enlarged; there are regular cross-Channel sailings to France (Boulogne and Calais). The chief church, dedicated to S. Mary and S. Eanswythe, is Early English, with a fine tower, much restored.

There is definite evidence that the site of Folkestone was in use during the Roman occupation, possibly as a naval base; in later years it became, and remains, a limb of the Cinque Port of Dover. It was early a corporate town.

FOLKLORE: ITS ORIGINS AND STUDY

E. S. Hartland, Author of *The Science of Fairy Tales*

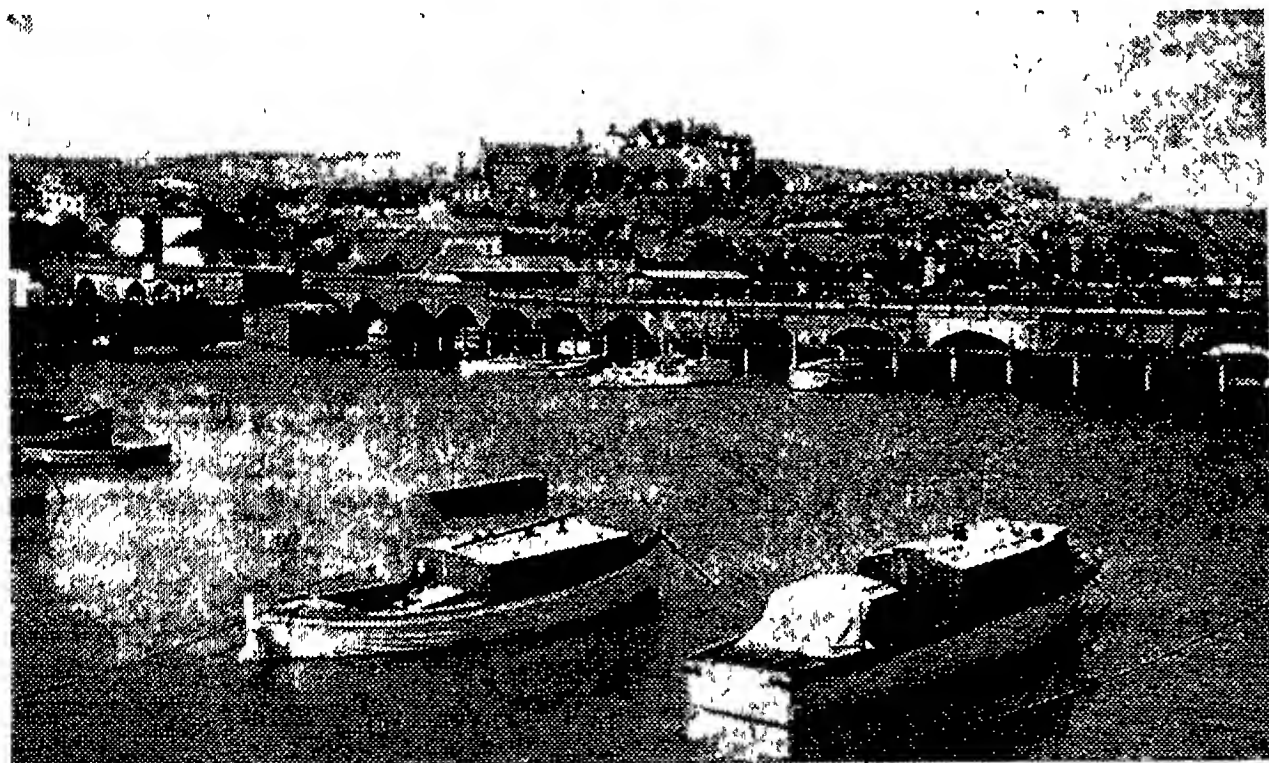
There are in this work articles on the various characters in folklore, among them Fairy; Genie; Roc; Valkyrie; Witch. See also Legend; Mythology, etc.

The term folklore was suggested by W. J. Thoms, the antiquary, in 1846, to replace the more cumbersome title of popular antiquities, hitherto used for the traditional tales, songs and sayings, customs and superstitions of the peasantry. On the foundation in 1878 of The Folk-Lore Society, it was adopted and incorporated into the name of the society. But researches and inquiries have compelled a broader view. All the evidence went to show that the traditional customs and institutions, songs, tales, and amusements, beliefs, leechcraft, and so forth of the peasantry in

civilized countries are survivals of an indefinite past, and for the most part bear the impress of a far ruder age; they present innumerable analogies to those of present-day savages; resemble them in the essential feature that they are traditional; and may reasonably be supposed to be ultimately derived from a social condition represented by many tribes which are still living in a low state of culture.

Accordingly in the second edition of *The Handbook of Folk Lore*, issued by the society in 1914, the definition adopted for the term folklore was "the generic term under which the traditional beliefs, customs, stories, songs and sayings current among backward peoples, or retained by the uncultured classes of more advanced peoples, are comprehended and included." The same term is used for the scientific study of these objects; and folklore as a science may be more succinctly and exactly defined as the study of tradition.

To quote the handbook again; "Folklore is the expression of the psychology of early man, whether in the fields of philosophy, religion, science and medicine, in social organization and ceremonial, or in the more strictly intellectual regions of history, poetry, and other



Folkestone. The inner harbour of this popular Kent resort

literature." It thus embraces the whole outlook of uncultured man upon the world, his beliefs concerning his own nature and destiny, his relation to other beings, whether objective or imaginary, whether human or non-human, the rites and customs which are the outcome of his beliefs and the expression of these varied relations, and, finally, the amusements of his vacant hours.

The English use of the word folklore does not include, as the corresponding German word *Volkskunde* does, the technology of the arts and industries practised either by the unlearned classes of civilized peoples or by the uncivilized or semi-civilized peoples of distant regions. The English student of folklore is concerned rather with the non-technical rules which govern the employment of implements, and with the ceremonies and taboos observed in relation to them, for these reveal the deeper thoughts of the community and the direction of its mental and spiritual life.

Old Devonshire Customs

Folklore may be said to be the deposit left by successive waves of culture on the minds of the community. The record is usually far too fragmentary to present anything like a history. What is preserved is that which—whether tale, institution, rite, or custom—has most deeply entered into the popular mentality. At the village of Holne, on Dartmoor, on May-morning before daybreak a ram-lamb used to be hunted down by the young men, fastened to a monolith, killed, and roasted whole. At mid-day a struggle took place for a slice of the animal, which was supposed to confer luck for the ensuing year on the fortunate person who ate it.

At King's Teignton, on Whit-Monday, a lamb is drawn about the parish in a cart covered with garlands. On the following day it is killed and roasted whole in the middle of the village; and slices are sold to the poor at a cheap rate. The custom is said to date back to heathen days, and to owe its origin to a drought, in which the inhabitants prayed for water. Their wants were supplied in answer to the prayer by the bursting forth of a spring, which even now is adequate in a dry summer to work three mills. The sacrifice of the lamb is said to be a votive thank-offering (Sir Laurence Gomme, *Ethnology in Folklore*, 1892).

In these two Devonshire customs it is impossible to avoid recognizing a survival from very ancient times of a sacrificial ceremony. It is a striking and picturesque rite; but from our point of view this is by no means essen-

tial to its preservation. Thousands of traditional observances are of a common-place character, some even disgusting; and it is difficult to say what quality in them caused them to survive. The prohibition, for luck, to put both shoe and stocking on one foot before the stocking is put on the other, has no striking or picturesque features, but the importance it attaches to a trifling detail in the order of dressing indicates that it descends from so remote a past that the original reason seems undiscoverable.

The belief that it is a bad omen if a child do not cry at its baptism, the prohibition in Scotland to give fire out of the house on New Year's Day, and many other precepts and beliefs obviously derive their origin from a much lower stage of culture. Of such survivals it may very often be said, in Sir Arthur Mitchell's words, that "they show the continuance among a people long Christianised of ceremonies and practices emphatically pagan." Where they cannot be said to be "emphatically pagan" they are alien in spirit from modern thought.

From time to time it has been sought to disentangle and classify such survivals, so as to show the ethnic elements of which they are composed. Thus, Sir Laurence Gomme argued that the sacrifice of the lamb in Devonshire was an inheritance from a pre-Aryan society and a pre-Aryan culture. W. H. R. Rivers instituted an elaborate inquiry into the different strata of the institutions and customs obtaining in the Melanesian islands of the South Pacific (*History of Melanesian Society*, 2 vols., 1914). He arrived at some very interesting results, but the questions raised are so complex, the influences are so numerous and varied, and many of them so hypothetical, that it cannot be said that the possibility of assigning the different elements of folklore to their original ethnic source has anywhere yet been demonstrated.

Folklore and the Historian

The value of folklore as a record of facts and of the succession of events is much more limited. Ancient historians—for instance, Herodotus—necessarily relied to a great extent on tradition. All through the Middle Ages, and even more recently, it was treated as authoritative. Modern historians have become more sceptical; and the untrustworthiness of oral tradition, in comparison with the more certain evidence of written documents or the statements of eye-witnesses, has been generally regarded as axiomatic.

In the lower zones of culture, however, documentary evidence of events long past is, of course, unprocurable. The evidence of tradition is the only direct evidence possible. In these circumstances some anthropologists have been disposed to rely on it for such matters as the origin and migrations of a people, the pedigree of its chiefs and rulers, the beginnings of its institutions, and the vicissitudes of its history.

Subjects of Tradition

Careful examination shows that this reliance is hardly justified. Illiterate persons certainly develop a greater strength of memory than those who habitually depend on books and written memoranda. But both individuals and communities differ widely in this respect: all are not gifted alike. Much depends, also, on the subject. Pedigrees may be remembered because they appeal to the vanity of a family, or because they are important in relation to the descent of property, or the headship of a clan. The interest thus aroused tends to preserve tradition. On the other hand it almost inevitably deforms it. Whether it be material prosperity, or only pride in the doings of ancestors, or the position of a family, what is sure to be insisted on is the glory and advantage of the carriers of the tradition, and the depreciation or the misdoings of their opponents; and where there is no precise record, there is no conclusive answer to their claims. These are, in a sense, private traditions.

Where a tradition is not so closely related to the interest of the individual, or of a close corporation, it is liable to become less definite, the details will be speedily forgotten, and though outstanding facts will continue to be longer remembered, they will remain isolated and unexplained. Ultimately they will pass out of memory, unless an effort to explain and account for them be made. For this explanation the imagination must be drawn on. Without any real historical sense, the story can only be reconstituted as the carriers of the tradition think it ought to have been, in accordance with their ignorance, their mental condition, and their consequent sense of the fitness of things. The result is a mere travesty of the facts, and oftentimes, indeed, is a complete reversal of them.

It might be thought that bare lists of kings or genealogies would be easily remembered by the aid of a fair memory, and would lend themselves but little to freaks of

imagination. In practice this is not so. Apart from the constant occurrence at the head of such lists of eponymous heroes whose former existence is a mere postulate to account for the name of a tribe or clan, a single example of the untrustworthiness of genealogies may be taken from the pedigrees of the chiefs of various sections of the great Thonga tribe in South Africa. It by no means follows that the names given in these pedigrees represent successive steps in the genealogy.

A step may be omitted because in the native mind for this purpose the distinction between a son and a grandson is immaterial. Steps may be duplicated, because a brother may have succeeded a brother in the chieftainship. Or a longer gap may intervene between two names represented as those of father and son. All these errors and others occur in the pedigrees in question, and the native depositories of tradition do not agree among themselves on the subject. The lists do not affect to contain the names of more than eight or ten generations, going back at the most from 200 to 250 years. Yet a Portuguese document dated in 1554 already mentions several of the names, some of which were then probably the names of clans rather than of persons, and two of them are in the document expressly stated to be the names of rivers (Junod, *Life of a South African Tribe*, i, 24-26).

A Typical Legend

A legend very widespread in England and other parts of the W. of Europe concerns the position of a church. It asserts that the church, generally a parish church, was intended to be built elsewhere than on its actual site, but that the materials and the building so far as erected were nightly removed by invisible powers, and that the builders were ultimately compelled to accept the site thus supernaturally chosen.

Two examples, both taken from Gloucestershire, will show how tradition may disguise, and in one case entirely reverse, the facts. The story of Bisley church is that it was to have been built in a certain spot definitely pointed out, but the stones were removed at night by the devil to its present site. Actually, the place pointed out as the intended site was the site of a Roman villa, from the ruins of which the materials for the church, or some of them, were obtained. When the church was restored in the 19th century, portions of the villa, including an altar of the Penates, were found embedded in

the walls (Gloucestershire N. & Q., i, 390). Of Churchdown church, a few miles away, on the top of an isolated hill, the tradition recorded is that it was begun "on a more convenient and accessible spot of ground, but that the materials used in the day were constantly taken away at night and carried to the top of the hill, which was considered as a supernatural intimation that the church should be built there."

The fact is that the hill-top was fortified probably from prehistoric times (the rampart is still to be seen), and the original village was there with its church, but that some time before 1170, doubtless in consequence of the greater security of the country, the village—but not the church—was removed down to the side of the hill, and the top subsequently became deserted. The tradition, now comparatively old, could not have originated until the history of the village had been forgotten.

Vagueness of Tradition

It may be said in general terms that the exact facts cannot be recovered from tradition after a century, or at most two. Subsequent to that they become vague, confused, and at length fade out of recollection. In France memory hardly goes beyond the Revolution. It is "a sort of chronological landmark, the only one, beside the reigns of some modern sovereigns and the war of 1870, which the people really knows" (Sébillot, *Folklore de France*, 1904-7, iv, 379). All beyond is vague or forgotten. "Before the Revolution" conveys the utmost antiquity.

Some American Indian traditions go back to the events of the 17th century. They are generally presented under more or less romantic guise, and they cannot be depended on. The Wyandots suffered a very great disaster about the years 1648-50: they were massacred, and the tribe was almost totally extinguished by the Iroquois. It might be supposed that so terrible an experience would have been deeply impressed on the minds of the people. So far, however, is this from being the case that "practically nothing seems to have been remembered" (Barbeau, *Huron and Wyandot Mythology*, 1915).

Instances like those cited might be multiplied indefinitely. They render it impossible to rely upon folklore to transmit a knowledge of events. What it does transmit is a record of the mentality of past generations and of earlier stages of civilization. Such a record is transmitted not merely by tale and song and saying, but

also—and perhaps still better—by game, institution, periodical observances, and the more intimate doings and cautions of daily and family life, as well as by the shapes taken by the beliefs in the supernatural and the uncanny. The problem for students of folklore is to unravel them, to compare them with familiar phenomena elsewhere, and to assign to each of them its place and meaning in human evolution. Consult *Handbook of Folk Lore*, C. S. Burne, 2nd ed. 1914; *Introduction to Folklore*, S. J. Brown, 1933.

Folk-Lore Society. British society formed with the object of collecting and preserving the relics of folklore. It was founded in 1878, and publishes a quarterly journal, *Folk Lore*, and also occasional volumes; it holds monthly meetings in term time at University College, Gower Street, London, W.C.1.

Folkmoot. Name given to a moot or meeting of the folk or people. There were moots of various kinds in medieval times, e.g. the shiremoot. Theoretically all freemen could attend, but practically nothing is known of the matter except that among the Teutonic tribes there were meetings of this kind. In England, according to one theory, there was a folkmoot in each of the little kingdoms until these were united and the witan became the dominant assembly. See *Moot*; *Witenagemot*; consult *Primitive Folkmoors*, G. L. Gomme, 1880.

Folk-Song. Song created by the common people, those whose cultural development has been effected, not by any formal system of training or education, but through the unconscious and intuitive exercise of natural and inborn faculties. Albeit folk-music is the creation of unlettered and technically unskilled musicians, it is not on that account embryonic, i.e. undeveloped or inferior music. The difference between the music of the people and that of cultivated musicians is one of kind, not of degree, akin rather to the difference between the wild and the garden flower—neither of which can be said to be incomplete or imperfect.

Folk-music ordinarily consists of melody only; it is very seldom—e.g. among the peasants of Great Russia—that it has been carried as far as the harmonic stage. Technically, the folk-tune is essentially non-harmonic in construction and implication, being devised by those in whom the harmonic sense is dormant. It is frequently cast in one or other of the diatonic modes more rarely of the chromatic,

and occasionally in the major, but never in the minor mode; and it is free in its rhythm, metrically irregular, often in five-time and other compound measures. Aesthetically, the characteristic of the folk-tune is its transparent sincerity, freshness, spontaneity, naïveté, and directness of statement.

These considerations, coupled with the fact that folk-tunes are invariably anonymous, have led to speculative theories concerning their derivation. Some experts maintain that folk-songs, like other songs, were composed in the past by individuals, and have been handed down more or less incorrectly by oral tradition, *i.e.* that the folk-song is not a genuine wild flower, but merely a garden escape. Others contend that folk-songs are the creation, not of individuals, but of homogeneous groups or communities; that the process of oral tradition has been responsible, not only for their preservation, but for the course of their development, and, in a sense, for their actual creation; that the alterations unconsciously made by individual singers have at every stage of the evolution of the folk-song been weighed and tested by the community and accepted or rejected by their verdict; and that the life-history of the folk-song has, therefore, been one of continuous growth ever approximating to a form congenial to the taste of the community and expressive of its feelings, aspirations, and ideals.

The weakness of the individualistic theory is that it fails to account not only for the anonymity of the folk-song, but also for its distinctive national flavour, which is, perhaps, the most characteristic and most valuable of its many peculiar qualities. It is because folk-song is pre-eminently a national utterance that its preservation is essential to the musical well-being of the nation of which it is the natural musical expression. No nation has suffered more than England through the failure to realize the necessity of maintaining a close connexion between its folk and its art music, as may be seen by contrasting the foremost position which the country held in musical Europe before Purcell, with the humble place to which it has since been relegated.

Fortunately for the future history of English music, the efforts that have been made since the beginning of the century to collect and record its popular music have been attended with a success far greater than, in the circumstances, could have been expected. In this all-important work the

English Folk Song Society, founded in 1898, has played a leading part, having already recorded in its Journal several thousand authentic folk-songs. In addition, several selections of harmonised folk-songs have been published by musicians and collectors, *e.g.* Lucy Broadwood, Ralph Vaughan Williams, George Butterworth, and Cecil Sharp.

Cecil J. Sharp

Follen, KARL (1795–1840). German poet. Born at Ramrod, Hesse, Sept. 5, 1795, he was son of a lawyer. He was educated at the university of Giessen and became a teacher of law, but his revolutionary ideas made it necessary for him to betake himself to Switzerland and then to the U.S.A. He became a professor of German at Harvard and later a Unitarian minister at Lexington. In Jan., 1840, he lost his life when on a burning steamer. He is known by his patriotic songs. His brother, August Ludwig Follen (1794–1855), was also a poet.

Follicle (Lat. *folliculus*, little bag). In anatomy, a minute gland or sac such as the hair-follicles of the skin. In botany, a dry dehiscent seed case, consisting of one carpel, which opens along the ventral suture.

Follies, THE. Pierrot troupe which achieved popularity in London, especially at the Apollo Theatre, and to a limited extent in the provinces, between 1907 and 1912. The Follies owed their success largely to the personality of H. G. Pélissier (d. 1913), who was their moving spirit and composed for them such songs as *My Moon*, and *The Toothbrush and the Sponge*, as well as writing sketches. Potted Plays, a series of burlesques of contemporary productions, were a feature.

Follow-on. A term used in cricket. When the side which takes its innings second makes a score of 150 or more runs below that of the opponents, it may be required to bat again immediately. Thus the captain of the leading team is relieved of having to decide when to close his second innings had he taken it, and may gain victory without batting again.

Folly. Name given generally to a building for which there appears to be no particular use or reason. The term is of twofold origin and derives from both the French word *folie*—meaning a pleasanee, a delight, or a whimsical phantasy, and as a rule applied to garden-pavilions, belvederes, or look-out towers—and from a castle built in the Welsh marches by Hubert de

Burgh. He had scarce completed it when, under the terms of a treaty with the Welsh, he was obliged to demolish the fortress. This futility was styled “Hubert’s Folly.”

A typical instance of what the rustic calls a folly is the Folly Gate of Brookmans Park, near Hatfield, an embattled red-brick structure of imposing design, thought to have been erected by Sir Jeremy Sambrooke in the 18th century. “Roebuck’s Folly” in the grounds of Midford Park, near Bath, is said to have been built in 1700 to commemorate the winning of a fortune by the ace of clubs. The Farmers’ Folly, a pillar erected at Alnwick in 1816 by the tenants of the duke of Northumberland, to testify to their appreciation of him, was completed by the duke at his own expense. Sham Castle, or “Allen’s Folly,” overlooking Bath, was built in 1760 by Ralph Allen. The palatial building erected at Font-hill, Wiltshire, by the author of *Vathek*, is sometimes referred to as Beckford’s Folly.

Folquet of Marseilles (c. 1150–1231). Provençal troubadour. He was the son of a merchant from Genoa settled at Marseilles. His few surviving poems show his amorous and passionate disposition; his verses won him the admiring friendship of distinguished men and gained him a place in Dante’s *Paradiso* (Book ix). He became abbot of Le Toronet, Provence, in 1198, and seven years later was made bishop of Toulouse. With Simon de Montfort he fanatically persecuted the Albigenses.

Fomalhaut (Arab. *fum al hūl*, mouth of the fish). Star Alpha in the constellation of Piscis Australis, the southern fish. It is a star of the first magnitude, and one of the four ancient royal stars. It can be seen low down towards the south in Great Britain in Sept. *Pron.* Fō-ma-lō.

Fomentation (Lat. *fovere*, to warm). Fold of lint or similar material, wrung out in boiling water and applied to relieve pain or inflammation, or to encourage the discharge of pus. It should be covered with jaconette, or oil silk, and cotton wool, in order to retain the heat as long as possible, and should be renewed every 3–4 hours.

Fomorian (Goidelic, sea-people, or giants). Legendary name of an early Irish race. They are claimed by some as Gaelic spirits of darkness and the sea, by others as an echo of the Viking age. Archaeology, however, points to early arrivals of Nordic “giants” from the Hebrides, and of early voyagers from the Mediterranean.

Fonblanque, ALBANY (1793-1872). British journalist. Son of a banker of French descent, he was born in London, and educated at Woolwich, intending to adopt a military career. At 20 he gained success as contributor to *The Morning Chronicle* and *The Times*. He succeeded Leigh Hunt as principal leader writer to *The Examiner*, of which journal he was proprietor until 1847. His intellectual radicalism and caustic wit exerted considerable influence in the political field, and in 1837 his articles were republished under the title *England under Seven Administrations*; a second edition was published in 1874. He died Oct. 13, 1872.

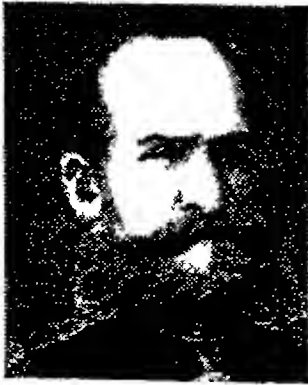
Fond du Lac. City of Wisconsin, U.S.A., the co. seat of Fond du Lac co. At the head of Lake Winnebago, 59 m. N.N.W. of Milwaukee, it is served by several rlys. It contains rly. repair shops, and is a shipping point for dairy and agricultural products and lumber. Manufactures include machinery, wagons, refrigerators, furniture, leather, and shirts. A Capuchin monastery is near by. Settled about 1836, it received a city charter 1852. Pop. (1950) 29,936.

Fondi (anc. Fundi). City of Italy, in the prov. of Latina. On the Appian Way, 11 m. N.E. of Terracina, it is enclosed by crumbling walls. Among its buildings are a cathedral, and a Dominican monastery in which Thomas Aquinas dwelt. Fundi was a Volscian town of some importance. It came under the sway of the popes in the 8th century, and suffered at the hands of Barbarossa in 1534. Fondi lies in a fertile district, and in ancient times was celebrated for its wine. Pop. (1951) 18,842.

Fonsagrada (Sp., sacred fountain). Town of Spain, in the prov. of Lugo. It stands on the slopes of the Cantabrian Mts., at an alt. of 3,166 ft., 26 m. N.E. of Lugo. It is a mart for local agricultural produce; industries include flour-milling and the manufacture of frieze and linen. Pop. (1950) 13,925.

Fonseca. Gulf of the Pacific Ocean. It penetrates inland to a depth of 40 m. and is bordered by Honduras, Salvador, and Nicaragua. Two volcanoes—Conchagua and Coseguina—stand on either side of its entrance, which is 21 m. wide. On the small island of Tigre in the gulf is the port of Amapali, a name by which the gulf is sometimes called.

Fonseca, MANOEL DEODORO DA (1827-92). First president of Brazil. Born at Alagoas, Brazil,



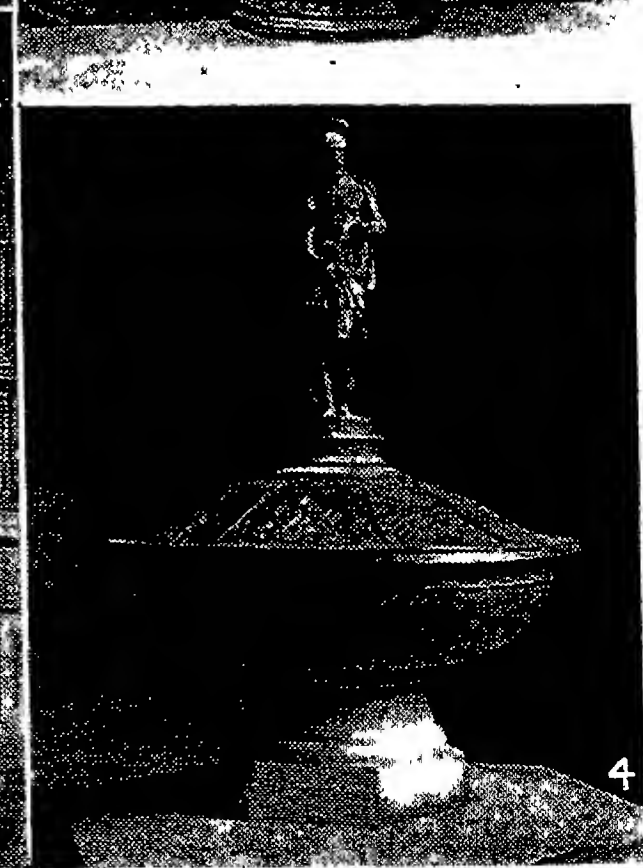
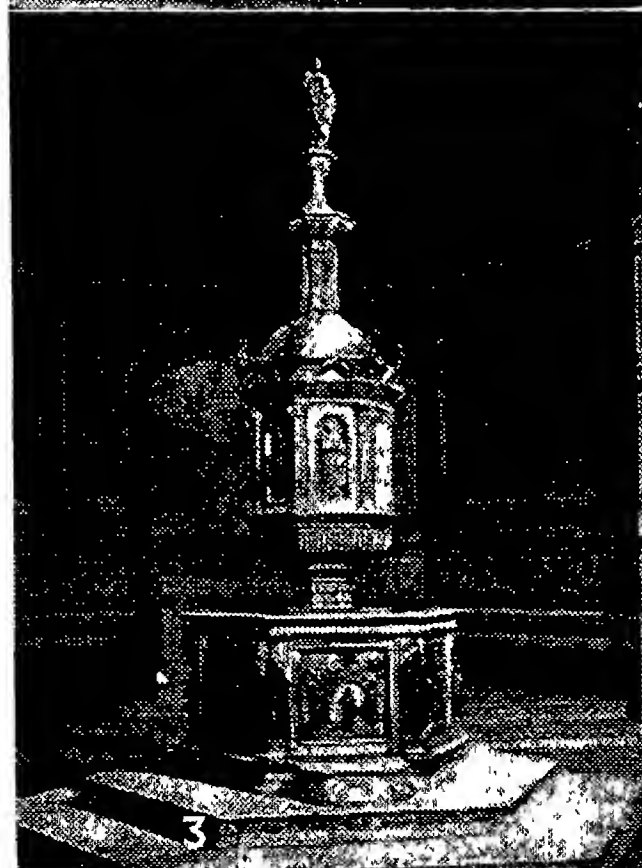
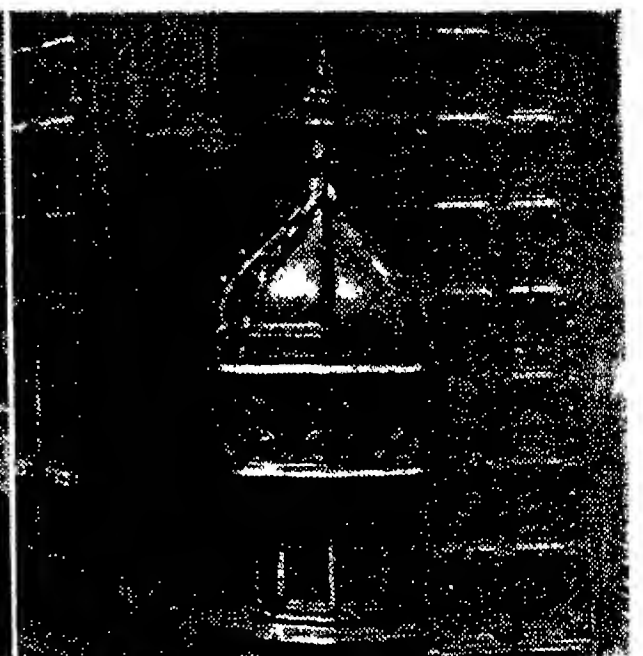
Manoel da Fonseca,
Brazilian president

Aug. 5, 1827, he joined the army in 1849. He was engaged, 1864-70, in the fighting against Montevideo and Paraguay, and rose to the rank of general. Though sympathetic with the republican party he was a personal friend of the emperor, Dom Pedro, and was in 1886 appointed governor of the province of Rio Grande do Sul. Becoming more closely identified with the republican movement, he was recalled; he headed the insurrection which was followed by the establishment of the republic of Brazil. He was appointed its first president in Feb., 1891, but resigned in Nov. He died on Aug. 23, 1892.

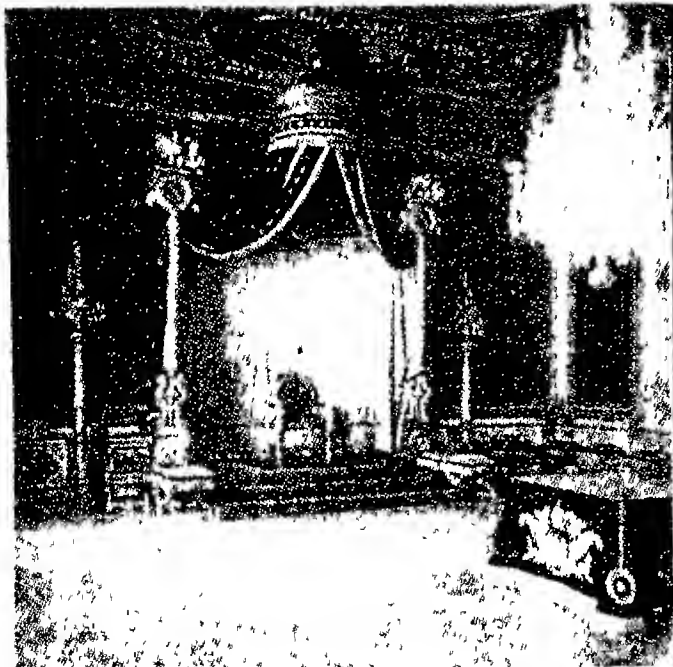
Font (Lat. *fons*, stem *font-*, fountain). In eccles. architecture, the basin for the rite of baptism. Constructed of marble, stone, or lead, it was placed in a part of the church re-

served for baptisms, or in a separate baptistery. Total immersion was customary in early Christian baptism, and at that time fonts were of considerable size. Gothic fonts were often covered by an elaborate lid; the church of Notre Dame at Hal, Belgium, has a font with a heavy brass cover removable by a crane attached to the wall.

Norman fonts are square or round, with massive pedestals, and are often ornamented with sculptured figures or other decoration; there were few sculptured fonts before this period, most Saxon examples being plain tub-shaped structures made, in the early period, of wood, but a few pre-Norman fonts are rudely sculptured. During the Gothic period fonts followed the line of general architectural development. Thus the pedestals in the 13th century are often made up of clustered shafts. Most of the extant font covers in Great Britain belong to the 17th century, but a few very beautiful covers were added to existing fonts during the



Font. 1. Carved Norman example in Hereford Cathedral. 2. Font in Henry VII's Chapel, Westminster Abbey. 3. Marble font, 1425-32, with bronze figures by Jacopo della Quercia, baptistery of S. Giovanni, Siena. 4. Marble font, 1546, and bronze cover with statue of S. John Baptist by F. Segala. 1565. S. Mark's, Venice

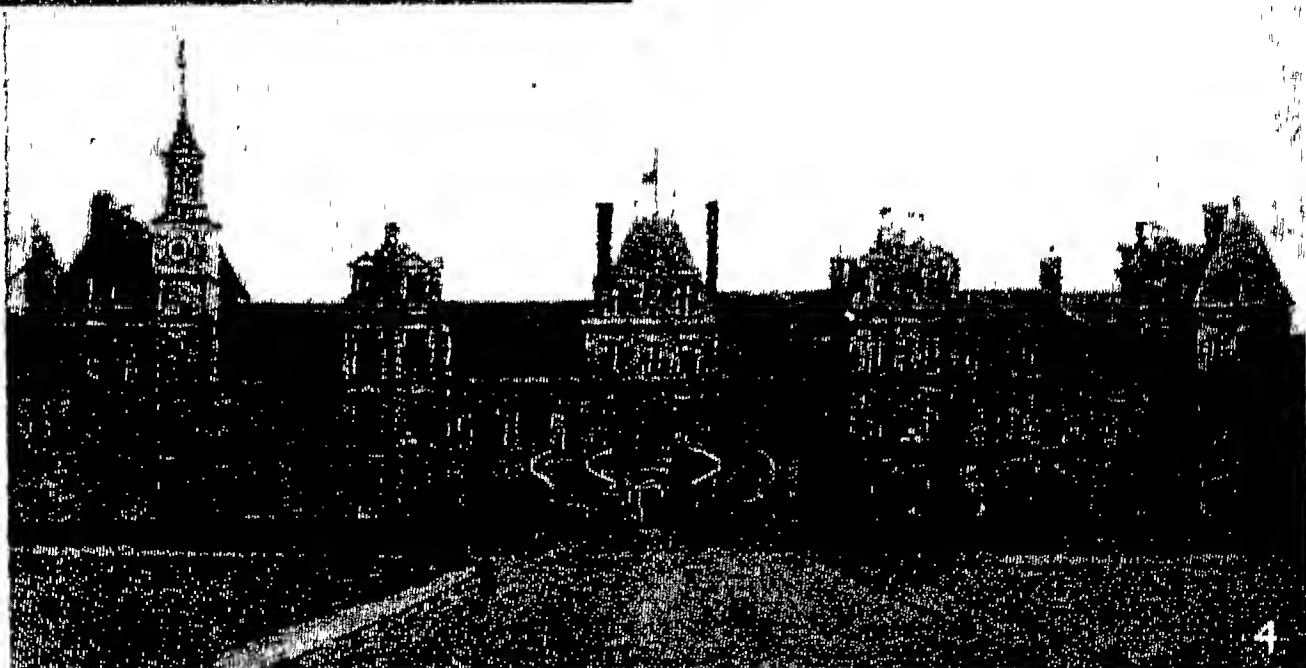
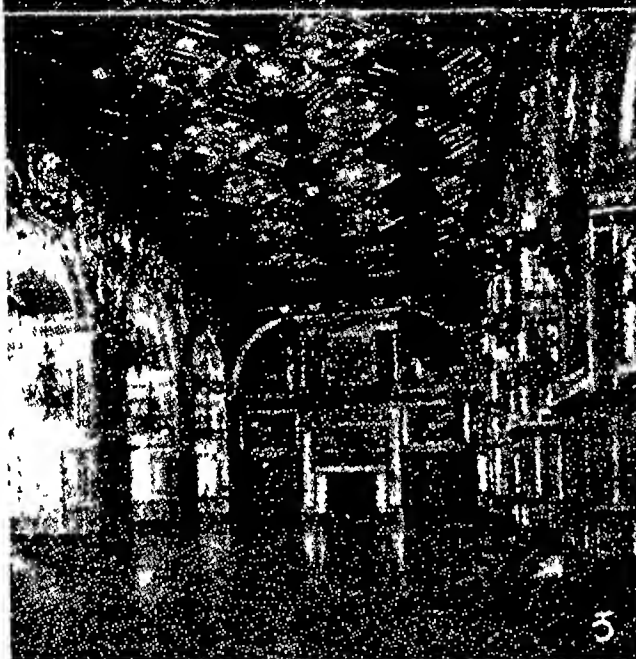


Georgian era. Such is the canopy to the 13th century font at Beverley Minster, which is fashioned in the Renaissance manner with cherub heads and other ornament.

Fontainebleau. Town and commune of France, in the dept. of Seine-et-Marne. Lying 37 m. S.E. of Paris on the Paris-Lyons rly., and about 1½ m. from the left bank of the Seine, it is famed chiefly for its palace and for the forest of Fontainebleau which surrounds it. The town has manufactures of porcelain and gloves, paving-stone quarries, and grows a fine type of dessert grapes. A favourite Parisian resort during the summer season, it has an important school of military engineering and artillery. Pop. (1954) 19,915.

The palace of Fontainebleau was founded probably by Robert II of France about 998, and rebuilt by Louis VII. His building was demolished by Francis I, who built a new palace on the same site, which was in turn expanded and ornamented by almost each successive monarch, and became the favourite dwelling-place of Napoleon I. It was also much altered and decorated by Louis Philippe between 1837-40. It remains one of the finest buildings in France, no less for its internal than its external and garden beauty. There are four principal courts forming the main structure: the Cour du Cheval Blanc, Cour de la Fontaine, Cour Ovale, Cour d'Henri IV. The staircase of Louis XIII, the gallery of Francis I, the banqueting hall, and many paintings and tapestries are notable. The palace has seen many historic events, including the signature of the revocation of the edict of Nantes, 1685, and the abdication of Napoleon I, 1814.

The forest, which is a state property, has an area of some 42,500 acres, and a circumference of nearly 57 m. Its beautiful mixed woods, covering broken and often rugged ground, have attracted many artists to the smaller vil-



Fontainebleau. 1. Napoleon's throne. 2. Bedroom of the Empress Josephine. 3. Gallery of Henry II, or ballroom, 16th century. 4. Cour du Cheval Blanc, where Napoleon bade farewell to men of the Old Guard, April 20, 1814

lages in and near them, notably to Barbizon (*q.v.*). It suffered severely from fires in 1895 and 1911.

Fontainebleau Sandstone. Division of the Oligocene system of rocks developed near Paris. It is notable on account of the remarkable purity of the sands, which are composed almost entirely of water-clear quartz, with high silica-content (over 99.65 p.c.), and of great value in glass-making.

Fontaine Notre Dame. Village of France, in the dept. of Nord. It is on the Bapaume-Cambrai road, 2½ m. W. of Cambrai. Captured on Nov. 21, 1917, by the British in the first battle of Cambrai, it was recaptured by the Germans in their counter-attack, and finally regained by the British in Sept., 1918. Pop. (1954) 1,446.

Fontana, DOMENICO (1543-1607). Italian architect. Born at Mili, Lake Como, he studied at Rome, where he obtained the patronage of Cardinal Montalto (Pope Sixtus V), becoming pontifical architect under him in 1585. His works included the Lateran Palace, the N. transept of S. John Lateran, Rome, and the lantern of the main dome of S. Peter's (according to Michelangelo's design). After Sixtus's death, 1590, he became royal architect at Naples, where he built the Palazzo Reale, and where he died.

Fontane, THEODOR (1819-98). German novelist and poet. He was born at Neu Ruppin, Brandenburg, Dec. 30, 1819. He first attracted notice by his romantic ballads; later, as novelist, he was known as an uncompromising realist. Some of Fontane's more notable stories were *Vor dem Sturm*, 1878; *Stine*, 1890; *Der Stechlin*, 1899; and *Cécile*, 1900. Having visited Britain three times, he wrote *Ein Sommer in London*, 1854, and in 1860 two vols. of letters and sketches concerning England and Scotland. He acted as war corre-

spondent in the Slesvig-Holstein campaign and in the Franco-Prussian War. He published his autobiography in 1898, and died at Berlin, Sept. 20, 1898. Consult *Theodor Fontane: A Critical Study*, K. Hayens, 1920.

Fontanelles (Fr., little fountains). Soft spaces present in the skull of the infant. The anterior fontanelle, the largest, is a quadrilateral area occupying the place where later the angles of the two frontal and the two parietal, or side, bones of the head will unite. The posterior fontanelle lies between the posterior angles of the parietals and the occipital bone which forms the back part of the skull. The lateral fontanelles, two on each side, are small and irregular in shape. The anterior fontanelle

does not completely ossify until a year or more after birth; the others close shortly before or after birth. The condition of the fontanelles considered with the age of the child affords indication of health and development to the physician.

Fontanne, LYNN (b. 1882). An American actress. Born in London, May 16, 1882, she first



Lynn Fontanne,
American actress

appeared on the stage in a Drury Lane pantomime, 1909. After a visit to the U.S.A., she played in London in popular pieces until 1916, when she joined Laurette Taylor at Rochester, N.Y., in *The Wooing of Eve*. Settling in New York, she scored a notable success in 1923 in *Sweet Nell of Old Drury*, opposite Alfred Lunt (q.v.). The following year she married him, and the partnership of "the Lunts" became world-famous. Their acting was remarkable for its precision, sense of timing, and smooth sophistication. Her memorable performances in London were in *The Guardsman*, 1924 (filmed 1931); *Caprice*, 1929; *Reunion in Vienna*, 1934; *Amphytrion* 38, 1938; *There Shall be No Night*, 1943; *Love in Idleness*, 1944 (renamed *O Mistress Mine* in New York).

Font de Gaume. Palaeolithic cave, 165 yds. long, in Dordogne, France. It contains many mural paintings, monochrome and polychrome, of the Magdalenian period, some of them masterpieces of prehistoric art. The bison, horse, reindeer, mammoth, and rhinoceros are depicted, besides a human face and hands, and designs of huts.

Fontenoy, BATTLE OF. Fought May 11 (N.S.), 1745, between the British, Dutch, and Hanoverians on the one side and the French on the other. The Allies' object was to relieve Fontenoy, a fortified village about 5 m. S.E. of Tournai, then besieged by the French.

The French under Marshal Saxe were drawn up across the road from Mons along which, coming from the S., the Allies had to advance. Obstacles had been placed in front, while on their right was the Scheldt and the fortified village of Antoing; on their left was the wood of Barri. The Allies under the duke of Cumberland arrived before this strong position on the 10th, and early on the 11th were

ready for battle. Allied attacks were repulsed, the Dutch in the centre failing to take Fontenoy.

After some delay the British and Hanoverian infantry made their advance. Lord Charles Hay of the Guards greeted the enemy with lively taunts, and the two lines opened fire. At closer quarters the fight was continued, and the cavalry were drawn into it. The British and Hanoverians had closed into a square, but after repelling the first attacks they were at length overwhelmed in the general *mêlée*. More French infantry were brought up; the artillery fire became more intense, and, most vital of all, a brigade of Irish bore down upon the Allies. The square was broken, but they withdrew from the field in good order, although they left behind some of their guns. The losses were about equal, something like 7,000 on each side. The British and their allies had about 45,000 men engaged; the French somewhat more. A monument at the village commemorates the Irish brigade.

Fontevrault-l'Abbaye (well of S. Evrault abbey). Town of France, in Maine-et-Loire dept. It is on the Vienne, 10 m. S.E. of Saumur. Here, in 1099, Robert d'Arbrissel (1047-1117) founded a great Benedictine abbey and an order after which it was named. The abbey, which at one time housed 300 nuns and 200 monks under the rule of an abbess, existed down to the time of the Revolution. The church, consecrated by Calixtus II in 1119, contains recumbent statues of Henry II of England and his queen Eleanor of Aquitaine, Richard Coeur de Lion, and Isabella of Angoulême, widow of King John. In 1804 the abbey buildings were converted into a prison. In 1910, when the abbey church was restored, the tombs of Henry II of England, his wife Matilda, and his son Richard I were discovered. Pop. (1954) 1,994.

Fonteyn, DAME MARGOT. Stage name of Peggy Hookham, British dancer, born at Reigate, Surrey, May 18, 1919, and educated at Louisville, Ky., and at Shanghai. She studied under Goncharov, Astafieva, and Ursula Moreton, making her début at Sadler's Wells in 1934 in *The Haunted Ballroom*. The first ballerina produced by the Vic-Wells co., when Markova left that company she inherited many of her leading rôles. Performances in *Giselle*, *Swan Lake*, *The Sleeping Princess*, *Les Sylphides*, and *A Wedding Bouquet* showed the extent of her emotional range.

She had instant success in New York in 1949, and in 1956 was made D.B.E. She played the ballerina in the first English production of *Petroushka*, 1957.

Fonthill OR FONTHILL GIFFARD. Village of Wilts, England, 13 m. W.N.W. of Salisbury. William Beckford (q.v.), who settled here in 1796, built Fonthill Abbey at a cost of over £250,000, and disposed of it and the greater part of its contents in 1822 for £330,000. A second Fonthill Abbey was built on the same site by the 2nd marquess of Westminster.

Fonvielle, WILFRID DE (1824-1914). A French aeronaut and author. Born in Paris, July 24, 1824, he early showed a genius for mathematics, and became a teacher. His opposition to Louis Napoleon during the revolution of 1848 caused his banishment to Algeria after the *coup d'état* of 1851, but he returned at the amnesty (1859), engaged in politics, and studied aeronautics. During the siege of Paris, 1870, he made his escape in a balloon, and went to London, where he gave political lectures. He died April 29, 1914.

Foochow OR MINHOU. Former treaty port of China, capital of the prov. of Fukien. It stands in a plain surrounded by hills on the river Min, 36 m. from its mouth. The town is enclosed by old and crumbling walls, pierced by seven gateways crowned by towers. The suburbs lie outside the walls, and are almost as extensive as the town itself. The river is spanned by the bridge of Ten Thousand Ages, which is a marvellous example of Chinese engineering; it connects with the island of Nan-tai, the European quarter. The bridge is supposed to be over 800 years old.



Margot Fonteyn. British ballerina,
the first produced by the Vic-Wells
ballet company

There are shipbuilding yards, an arsenal, a dry dock, numerous wharves, and a school of navigation. The leading industries are connected with cotton goods, timber, tea, paper, matches, spices, cereals, and ores, while there is a large trade with the maritime provinces of China.

Foochow was opened to foreign trade in 1842. In 1941 it was captured by the Japanese on April 21 but reoccupied by the Chinese on Sept. 3. The invaders took it again on Oct. 8, 1944, after bitter fighting, and the Chinese regained it on May 18, 1945. Pop. 322,725.

FOOD AND NUTRITION

Lord Boyd Orr, Director-General, United Nations Food and Agriculture Organization, 1945-48

Food and its constituents, their effect on human health and energy, the minimum requirements of the average man: these are some of the facts here explained by one of the world's greatest food experts. See Food Control; Food Preservation: also Fisheries; Flour; Fruit, etc.

Food is the term applied to substances eaten to sustain life. Nutrition deals with the chemical composition of foodstuffs, the function of their constituents and their adaptation for maintaining health.

The main activities of undomesticated animals are absorbed in the struggle for food. The same is true of man. It is only within comparatively recent times that as many as 15 or 20 p.c. of the world's population have had a reasonable assurance of sufficient food for health. The fight for food has been the main cause for migration of people and the driving force among the masses in great political movements when migration no longer offered prospects of more food. That was true of the French Revolution and also of the Chartist movement in England. After the Napoleonic war the price of bread was so high in proportion to wages that the children of the working classes in the industrial areas had to earn their bread or starve.

Need for Production

The struggle for food still exists. The land hunger of peasants in eastern Europe and elsewhere is due not so much to a desire to be landlords as to a desire for freedom to retain for their own needs sufficient of what they produce. In Asia lack of food may be the great world political problem of the 20th Century. The population is already more than the land, with primitive methods of cultivation, can support, and it is estimated that by 1970 it will have increased by 400 million, equal to the population of Europe. There will be an explosion of the population unless agriculture and industry are developed to increase home production and imports of food.

A century and a half ago Malthus predicted that growth of the world population would outrun its capacity to produce food. Recently students of population

changes have expressed the same fear. It is estimated, however, that with the scientific knowledge available it would be possible to produce sufficient food for three times the present population of the world. The only absolute limit to food production is the amount of solar energy the earth receives. Only an infinitely small percentage of that is transformed into the food people eat. Where anything grows, food can be produced. The only practical limit to food production is the amount of labour mankind is prepared to devote to it, and the willingness of governments to cooperate in plans on a world scale to apply science to develop the natural resources of the world.

Food to Maintain Health

The preoccupation with food has developed an instinct which guides both men and animals in the selection of the kind of food needed to maintain health. Where the foods available are deficient in some essential ingredient, this instinct drives animals to seek what is deficient. Cattle grazing on pasture deficient in certain mineral elements eat earth rich in what is lacking. They make long treks periodically to the "salt licks." Pigs kept in confinement on food deficient in lime dig out the lime between the bricks of the pens. This craving for what is deficient in food is called "pica." Human beings show the same instinct. Food taboos and customs among native tribes, which appear irrational to Europeans, in most cases originated from observations of cause and effect. Many of these curious customs foreshadowed discoveries in nutritional science. It has recently been discovered that endemic goitre is associated with a lack of iodine. The Greeks knew that eating sponges and seaweed, which are now known to be rich in iodine, prevented goitre. Pregnant

women in China ate powdered reindeer horns long before medicine realized that the need for calcium is doubled in pregnancy and lactation. American Indians knew how to cure scurvy by eating pine needles long before Vitamin C was discovered. Science has provided an explanation for much of this traditional empirical knowledge and cleared it of superstition. The principles have been elucidated and stated in exact terms which enable them to be applied with greater certainty.

The science of nutrition which has made such a great advance on traditional knowledge began with Lavoisier, who lived about the time of the French Revolution. His researches proved that the heat needed to maintain body temperature and the energy needed for muscular work were derived from the oxidation of carbon compounds in the body, and that these are supplied by food. He also showed that the amount of oxygen absorbed from the inhaled breath and the amount of CO₂ given off in the exhaled breath correspond with the total heat and muscular work produced in the body. This discovery of Lavoisier's made it possible to measure the total amount of energy expended by the body under various conditions of external temperature and amount of work done. The next step was to find out how much energy was available in foodstuffs. Liebig, a German chemist who had studied in Paris, took the lead in devising chemical methods for determining the amount of available energy in proteins, fats, and carbohydrates, the three constituents of food which yield energy, and the amount of each in different foods. Biochemistry was developed by the search for such methods of analysis.

Calorimeter Experiments

In the 19th century, by experiments with the calorimeter, a knowledge of energy requirements of the body was obtained and the chemists worked out the available energy of different foodstuffs. By the end of the century it was possible to determine the amount of food needed for heat and muscular work under different conditions.

As protein is the main constituent of living tissue, it was considered of special importance. It was thought that while fats and carbohydrates could supply heat, it was from protein that the energy for work was obtained. All three constituents can, in fact, yield energy for heat and consequently

for work, and in calculating food requirements they are interchangeable in isodynamic, *i.e.* equal energy-yielding, proportions.

In the beginning of the present century it was assumed that if the diet yielded sufficient calories for heat and energy and contained sufficient protein for growth and replacement of used-up tissues, the needs of the body for food would be met. Diets were therefore calculated in terms of calories and protein, and research on the physiology of nutrition was confined largely to studies of energy exchange and protein metabolism. Dietetics was based on physics and chemistry, which indeed are the logical outcome of the investigations of Lavoisier. His researches were not on the nutrition of the body. They were on the nature of heat and energy. He believed that the body obeyed the same laws of thermodynamics as a machine and used it to demonstrate the principles which replaced the old idea of phlogiston (*q.v.*).

Discovery of Vitamins

In the beginning of the present century the physics and chemistry of dietetics began to be supplemented by biological tests. This new line of investigation showed that foodstuffs in their natural condition contained substances now called vitamins which are as important for maintaining life as calories or proteins. It was also found that mineral elements were of greater importance than had been thought. Many commonly occurring diseases, the cause of which had long been a mystery, were found to be due to a deficiency of vitamins or of minerals in the diet. This discovery of the vitamins and the new appreciation of the profound effect of food on health led to a great expansion of research on nutrition to determine the chemical composition of vitamins, how much of each is needed to maintain health, and the amount of vitamins contained in different foodstuffs. In addition to calories and proteins food requirements are now stated in terms of a dozen or more vitamins and minerals.

The constituents of food are usually considered as falling within the following groups: carbohydrates, fats, proteins, minerals, vitamins, and water.

Carbohydrates contain only the three elements carbon, hydrogen, and oxygen, the two latter always in the same proportion as in water, H_2O . There are three kinds of carbohydrates — namely, sugars,

starches, and celluloses. Examples of sugars are glucose $C_6H_{12}O_6$, which occurs in fruit juices and also in the blood, and sucrose $C_{12}H_{22}O_{11}$, which is found in beet and in sugar cane. Plants such as wheat, rice, and potatoes store their food reserves in the form of starch, and this provides the main part of our carbohydrate supply. Glycogen, or animal starch, is formed from glucose in the liver and muscles of living animals and acts as a reserve store of energy. Cellulose forms the fibrous parts of cereals, fruits, and vegetables. It is not digested by man, but it helps to stimulate the muscles of the intestine.

Fats contain the same three elements as do carbohydrates but the proportion of oxygen is much lower. They consist almost entirely of the glyceryl esters of various fatty acids, of which the most commonly occurring are stearic, palmitic, and oleic acids. They contain also what is termed chemically "unsaponifiable matter," which though it constitutes only 1 to 2 per cent of the fat itself, is nevertheless of great nutritional importance, since any vitamins which the fat contains are in this fraction. Fats are present in considerable amounts in animal tissues, and they occur also in many seeds such as cottonseed and linseed. As a source of energy, fat is the most concentrated of all foods.

Proteins are essential constituents of all plant and animal cells. They are highly complex compounds of amino acids, more than 20 of which are known to the chemist. The composition and the characteristics of a protein vary according to the nature and the proportion of the amino acids it contains. All the proteins contain nitrogen in addition to carbon, hydrogen, and oxygen, many contain sulphur as well, and some contain phosphorus. While plants can manufacture proteins from inorganic materials (derived from the soil and from the air), animals cannot do this, and must have provided in their diet readymade proteins of plant or animal origin from which they can obtain the amino acids essential for building up their own body tissues. Plant proteins differ from animal proteins both in the number and the proportion of their constituent amino acids. Generally speaking, animal proteins are superior nutritionally to plant proteins, and it is customary to refer to the former as good or first-class proteins, and

the latter as poor or second-class proteins. One protein will, however, supplement another, so that a mixture of animal and plant proteins is biologically more valuable than is either class taken alone.

Mineral constituents. In addition to proteins, fats, and carbohydrates, foodstuffs contain various mineral or inorganic constituents. The following are known to be essential for normal nutrition, since they are required for structural purposes and for the physiological functioning of the body: calcium, phosphorus, magnesium, sodium, potassium, chlorine, iron, copper, iodine, and manganese. Many of these mineral constituents are needed only in minute quantities, but they are nevertheless very important for the maintenance of physical well-being.

Vitamins are chemical substances present in foodstuffs in very small amounts which are necessary for health but which, with one exception, *viz.* Vitamin D, the human body cannot manufacture for itself. That certain unknown substances were essential for the maintenance of health in addition to the "classical" nutrients, protein, fat, carbohydrates, and minerals, had long been suspected. It was only in the second decade of the present century, however, that their existence was definitely established. As their composition was unknown they were designated by the letters of the alphabet, Vitamins A, B, C, etc. Originally Vitamin B was considered to be a single entity, but it is now known that several different substances are contained in the original Vitamin B. These include Vitamin B_1 , riboflavin, nicotinic acid, and pyridoxin. The chemical structure and properties of many vitamins have now been determined, and it is therefore customary to refer to them as specific substances, *e.g.* Vitamin C as ascorbic acid, Vitamin B_1 as aneurin, etc.

Classes of Nutrients

Foodstuffs in their natural state contain these classes of nutrients, together with water, in varying proportions. Animal products, *e.g.* meat, fish, milk, and eggs, are rich in protein and fat, while plant products such as cereals are richer in carbohydrate than in protein. Animal foods contain the fat-soluble Vitamins A and D, while fruits and vegetables contain the water-soluble Vitamin C and Vitamin A, in the form of carotene. Cereals are rich in the B vitamins.

NUTRITIVE VALUE OF 100 gm. OF SELECTED FOODSTUFFS (EDIBLE PORTION)*

Foodstuff	Water (p.c.)	Food energy (calories)	Protein (gm.)	Fat (gm.)	Carbo- hydrate (gm.)	Cal- cium (mg.)	Phos- phorus (mg.)	Iron (mg.)	Vitamin A (I.U.)§	Vitamin B (mg.)	Vitamin C (mg.)
Beef	67	193	18.9	13	0	11	204	2.8	0	0.12	0
Eggs	74	158	12.8	11.5	0.7	54	210	2.7	1140	0.12	0
Milk	87	69	3.5	3.9	4.9	118	93	0.07	160	0.04	1
Cheese	39	393	23.9	32.3	1.7	873	610	0.57	1740	0.04	0
Granulated sugar ..	0.5	398	0	0	99.5	0	0	0.1	0	0	0
Whole wheat flour ..	11	360	13	2	72.4	38	385	3.8	0	0.56	0
70 p.c. extraction flour	13	350	13.1	1.2	71.6	13	100	1.8	0	0.69	0
Potatoes	77.8	85	2	0.1	19.1	11	56	0.7	0	0.11	17
Cabbage	92.4	29	1.4	0.2	5.3	46	31	0.5	800†	0.07	52
Carrots	88.2	45	1.2	0.3	9.3	39	37	0.8	9000†	0.07	6
Oranges	87.2	50	0.9	0.2	11.2	33	23	0.4	190	0.08	49

* Figures derived from Tables of Food Composition, U.S. Department of Agriculture, Miscellaneous Publications, No. 572, 1945, and Nutritive Value of War-time Foods, Medical Research Council Memo, No. 14, 1945.

† Present as carotene, and determined biologically.

§ International units

The table above shows the average composition of some representative foodstuffs.

DIGESTION. This is the process of breaking down food into soluble constituents which can be absorbed from the alimentary canal, and is done by ferments or enzymes which are present in juices secreted by glands in the lining of the canal, and in pancreatic juice and bile secreted by the pancreas and the liver, respectively. The pancreatic juice and bile pass into the duodenum by special ducts. The enzymes act as catalytic agents, accelerating the breakdown of the ingested food material, while themselves remaining relatively unchanged. Each enzyme has a specific action affecting only one type of compound, *e.g.* pepsin acts only on protein, lipase only on fat, and amylase on starch.

Process of Digestion

The process of digestion begins in the mouth, where the food is broken up by chewing and mixed with the saliva, which is secreted by glands in the mouth. The saliva is slightly alkaline and contains an enzyme (maltase) which breaks down some of the starch in the food into sugar. After mastication the bolus of food is collected on the tongue, which pushes it back into the oesophagus or gullet, while the soft palate is lifted to cut off the passage to the trachea or windpipe. The food passes from the oesophagus to the stomach which acts as a reservoir. Contractions of the muscular wall of the stomach ensure further mixing and mechanical disintegration of the food, which at the same time is mixed with gastric juice secreted by the stomach. This juice contains 0.2 to 0.4 p.c. of hydrochloric acid, and also the enzyme pepsin, which is responsible for the partial breakdown of proteins.

The contractions of the stomach wall pass the food forward to the small intestine and duodenum

through the pyloric valve, a muscular ring at the junction of the stomach and intestine. This valve relaxes from time to time to allow the passage of part of the stomach contents. In the small intestine, rhythmic movements of the walls churn up the food and mix them with the digestive juices, which include pancreatic juice and bile. Further digestion then takes place as the result of the action of enzymes present in these juices. Thus starch is broken down by amylase to glucose, the proteins, already partially digested in the stomach, are split into still simpler compounds by trypsin, and fat, by the action of lipase from the pancreatic juice together with bile, is emulsified and broken down into soluble constituents which can be absorbed into the blood.

Absorption of the digested nutrients takes place mainly through the mucous membrane of the small intestine. The rhythmic movements of the intestine force the unabsorbed food material, and the waste matter excreted from the blood into the gut, into the large intestine. Here water is absorbed by the walls of the gut and the partially dehydrated material passes to the rectum, from which it is excreted from the body through the anus as faeces.

Mental Effects on Digestion

The digestive processes are involuntary, but they are affected by the mind. The smell or even the thought of food can produce appetite and cause an outpouring of saliva "making the mouth water." Moreover, the movements of the intestine are affected adversely by emotions of fear, worry, and anger.

METABOLISM. In every active living cell a continuous cycle of chemical changes is going on, compounds being built up and broken down, energy being liberated and waste material excreted into the surrounding fluid. These changes are termed metabolism. They de-

pend on the food constituents absorbed from the gut. When these pass into the blood stream soluble carbohydrates (in the form of glucose) and fat may be carried direct to the tissues to be oxidised to yield energy. If, however, there is already sufficient in the blood to meet immediate needs the glucose is converted to glycogen and stored in the liver and muscles, while the fat is stored as such in the fatty and muscular tissue. These stores can be mobilised as sources of energy when required.

Surplus Amino Acids

The amino acids are linked in certain proportions and combinations to form the characteristic proteins of the body. As the composition of the proteins in the food is different from that in the body proteins, many amino acids are surplus. The nitrogen of these is split off and converted to urea in the liver and carried by the blood to the kidneys to be excreted in the urine. The remaining part is oxidised in the same way as the carbohydrates or fats to yield energy for work or heat. Minerals in excess of requirement are excreted in the urine or the faeces.

While the effect of a deficiency of one or other of the vitamins is well known, the rôle that they play in the metabolism of the body is not yet fully understood.

FUNCTIONS OF FOOD. From food the body derives energy for maintenance of body temperature, muscular work, etc., and constructive material for growth and replacement of wastage of the tissues. Fats and carbohydrates are the chief sources of energy, while protein is the source of material for growth and repair of the soft tissues. Protein in excess of these requirements can, however, be used for the purpose of producing energy.

Of the minerals present in food, calcium and phosphorus are required in largest amount, since

they are necessary for the formation of the teeth and the skeleton. Sodium, potassium, and chlorine function in the body in various ways, *e.g.* by maintaining the osmotic pressure of the body fluids, the acidity or alkalinity of the various digestive juices, and so on. Iron is an essential constituent of haemoglobin, the red pigment of the blood. Traces of copper also are necessary for the formation of this pigment. Iodine is required for the secretion of the thyroid, though only in small amounts, but if these are not available, a serious disturbance of the metabolism occurs. Other minerals, such as manganese, are required in minute quantities and the exact rôle which they play in the body is as yet obscure, but that they are of vital importance is shown by the fact that where they are absent from the diet, the metabolism becomes abnormal and signs of malnutrition appear. As in the case of the enzymes, each of the vitamins has specific functions to perform. When the diet, although adequate in other respects, is lacking in any particular vitamin, the specific functions are not performed, and a disorder, characteristic of this vitamin deficiency, is produced.

Vitamins A, B, C, and D

It is known that an adequate supply of Vitamin A is associated with the capacity of the mucous membranes to resist local infections and with the maintenance of a healthy skin. It is also necessary for the formation of the visual purple of the retina, which is required for seeing in a dim light. This vitamin occurs in foods either as the preformed vitamin, or as its precursor carotene, an orange-red pigment which can be converted by the human liver into Vitamin A. This pigment is found in green vegetables, and is particularly abundant in carrots. Vitamin B₁ is concerned with carbohydrate metabolism. In its absence the disease beri-beri occurs, which is characterised by lesions of the nervous system, the cells of which depend on carbohydrate for their energy supply. When the carbohydrate metabolism becomes abnormal as the result of vitamin B₁ deficiency, pathological changes take place in the nerve cells. Vitamin C is essential for the formation of bones and cartilage and for the proper healing of wounds. A deficiency of Vitamin C results in scurvy, a disease

in which there is weakness and pain in the limbs, swelling and bleeding of the gums, and loosening of the teeth. Vitamin D is indispensable for the laying down of calcium and phosphorus in the bones and teeth. When this vitamin is not available either because it is absent from the food or because the body is at the same time deprived of sunlight (which enables it to manufacture its own Vitamin D), rickets develop. In this disease, to which children in particular are subject, the bones, owing to lack of proper calcification, readily become deformed. Such deformities may persist into adult life, with, in some cases, serious consequences to the individual.

DIETETICS might be defined as the practical application of the science of nutrition. It deals with the amounts of each food constituent required for health by males and females of different ages and varying activities. The first estimates of food requirements were made by ascertaining what people actually ate. As the science of nutrition developed, requirements were arrived at by experiments in which men were placed in enclosed chambers known as respiration calorimeters. In these experiments the intake of food and oxygen was determined and the energy expenditure of the body, either active or at rest, was measured in terms of the heat produced. Similar information can be obtained by an indirect method, in which the amount of oxygen breathed in and the amount of carbon dioxide breathed out during a given period is determined. By such experimental methods sufficient data have been obtained to estimate with some degree of accuracy the amount of potential energy which must be supplied in the food to meet the requirements of the body for heat and muscular work.

The Calorie as the Unit of Energy

The unit used in measuring the potential energy of foods is the calorie, which is the amount of heat required to raise 1,000 gm. of water 1° C. We know from experimental data the amount of heat given out by the different classes of foodstuffs when they are burned. One gram of protein and 1 gm. of carbohydrate each yield approximately 4.1 calories, while 1 gm. of fat yields 9.3 calories. Since the proportions of these constituents in the various foodstuffs are known, the energy

value of a food can readily be calculated. It is evident that foods containing much fat will have a high calorie value, while succulent foods, such as fruit and green vegetables, will supply very little energy.

Variation in Calorie Requirements

The calorie requirement of men is as a rule greater than that of women, but the requirement of individuals is dependent on the amount of muscular work which they perform. The following table shows the variation in calorie requirements of men engaged in different types of employment.

Calories per day

Very heavy work (coal miners, lumbermen)	4,000-6,000
Heavy work (stonemasons, dock workers)	3,500-4,000
Moderately heavy work (carpenters, shoemakers)	3,000-3,500
Sedentary work (clerks, tailors)	2,000-2,500

Though the requirements for various other nutrients cannot yet be estimated with any great degree of accuracy, it is possible from the available evidence to state what amounts of the essential food constituents should be included in practical diets to maintain well-being.

ECONOMICS OF FOOD. In the 19th century the food problem in Europe was one of finding sufficient food to satisfy hunger. In England in the early 19th century, the price of a 4-lb. loaf rose as high as 1s. 6d., and wages were very low. After the repeal of the Corn Laws in 1846, cheap wheat came in from the virgin lands of N. America. By the end of the century the price of a 4-lb. loaf was 5d., and wages were almost double what they had been in the early part of the century.

Almost all the working class could obtain sufficient bread and it was thought that the political and economic problem of food was solved. But the discovery of vitamins led to investigations into the adequacy of diets for health. It was found that even in the wealthiest countries, such as the U.S.A. and the U.K., nearly one-third of the population did not enjoy a diet on the health standard. This was due to the fact that foodstuffs rich in proteins, vitamins, and minerals are more expensive than those which are poor in these constituents. Consequently the lower the family income the greater is the proportion of these cheap and less nourishing foods in the diet.

The following list, compiled by G. Morgenstern, shows the cost in pence of 1,000 calories of some common foods in Jan., 1946.

Bread	2.0
Margarine	2.1
Sugar	2.3
Potatoes	4.1
Butter	5.9
Cheese	7.0
Beef	9.6
Milk (fresh)	12.9
Eggs (fresh)	25.5
Vegetables and fruit	40-100

After the world economic crisis of 1929-33, which led to large-scale unemployment with resulting decrease in purchasing power of the working classes, the price of foodstuffs fell below the cost of production, bringing ruin to farmers. In Europe and in N. America, government measures were introduced in an attempt to restrict production and imports in order to raise prices. But at the same time it was known that more than half the world's population suffered ill health due to lack of sufficient food. At the League of Nations assembly in 1935, proposals were put forward for a plan for the "marriage of health and agriculture," i.e. to increase consumption among the badly fed people of the world and so provide a market for all the foodstuffs produced. An international committee of economic, agricultural, and nutrition experts was set up to investigate the food and agricultural problems. This committee made certain recommendations, including the setting up of national committees by each of the governments adhering to the League to investigate the food position. A meeting of representatives of the committees of 20 governments was held in 1938. The outbreak of war in 1939 brought this movement to a close. In 1943, President Roosevelt invited the United Nations to send representatives to a conference at Hot Springs to consider what measures should be taken to bring about freedom from want of food to all men in all lands. A report of the committee led to the setting up of the Food and Agriculture Organization (*q.v.*) of the United Nations.

Wartime Fall in Production

During the Second Great War, owing to the fall in food production on the continent of Europe and in certain parts of Asia, and also to difficulty in transport, there was a shortage of food in many countries. The shortage became more acute after the war finished, owing largely to the disastrous

world harvests of 1945. This post-war food crisis in the war-devastated countries was dealt with by Unrra (*q.v.*) and later by the International Food Council set up in 1946 by the Food and Agriculture Organization.

War has always been accompanied by an increased demand for food and followed, as after the First Great War, by decreased demands and a resulting fall in price. Other factors such as good and bad harvests, level of unemployment, etc., also affect prices. In nine of the ten years between 1928 and 1938 the price of wheat in the world market fluctuated by over 70 p.c. This fluctuation in price is the bane of agricultural producers. In recent years several governments have attempted to stabilise prices. But the food and agriculture problem is interlocked with industry, trade, and international finance, and cannot be solved by measures dealing only with food and/or agriculture. The provision of a food and health standard depends as much upon the industrialisation of undeveloped countries, where hunger and malnutrition exist, as upon the development of agriculture. The economic problems of food production and consumption must be studied in the light of these wider issues.

Food, INSPECTION OF. Government service in Great Britain, the U.S.A., and other countries maintained to ensure that food supplied to the public reaches defined standards of composition, purity, and soundness. An Act to make the adulteration of bread illegal was passed in Great Britain in 1836, since when a number of Acts dealing either with particular commodities or with food as a whole, as well as sections of general Public Health Acts, have made more stringent the regulations governing the sale of foodstuffs, and extended the powers and duties of authorised inspectors to see that the regulations are carried out.

These various enactments were consolidated in the Food and Drugs Act of 1938 which brought under one comprehensive act all aspects of food and drug inspection, including the treatment of unsound food, precautions to be taken against food poisoning, purity of milk, hygienic condition of dairies, markets and slaughter houses, cold stores, etc. The ministry of Health is the responsible authority, the minister having power to make and necessary regulations.

In all counties and in the larger towns there are food and drug inspectors, who are sometimes also sanitary inspectors and inspectors of weights and measures. All county councils must, and large towns may, appoint a duly qualified public analyst who must be a highly skilled chemist holding special diplomas such as the fellowship of the Royal Institute of Chemistry in this branch. The inspectors have statutory powers to take samples which they submit to the public analyst, who examines them and issues an appropriate certificate showing whether or not the sample is satisfactory. If it is not, then legal proceedings may be taken against the vendor, the manufacturer, or the distributor according to the circumstances. Other duties of the inspectors include the examination of meat, of slaughter houses, meat markets, etc.; this branch calls for possession of a special diploma. All local authorities have a medical officer of health who is concerned with some aspects of food inspection and may impound food which he has reason to think is likely to cause poisoning.

Inspecting Food from Abroad

Under the Food and Drugs Act, port authorities, customs and excise officers, and medical officers of health for the port have to supervise food arriving in Great Britain. Such food is inspected, sampled, and analysed, or examined bacteriologically. In dealing with food, port officials combine three distinct functions: the exclusion of diseased or unsound food, the collection of customs dues on dutiable foods or constituents, and the enforcement of regulations as to composition or purity.

Most civilized countries have pure food laws and systems of inspection much on the same lines as those in Great Britain. In the U.S.A. a Federal Food and Drugs Law has superseded many of the individual state laws; that country has a very thorough system of meat inspection. In the Netherlands and in Switzerland the examination of milk and dairy products is particularly effective, being accomplished largely by regional laboratories so situated that it is possible to bring in all samples quickly—a matter of importance in controlling the bacteriological condition of milk supplies. France has very well developed inspection of meat and slaughter houses, and very numerous detailed regulations for particular foods and wines. Some food exporting countries

inspect food for export carefully, *e.g.* meat in New Zealand, fruit in South Africa, in order to ensure that food sent abroad attains a required minimum standard.

H. E. Cox, Ph.D., D.Sc., F.R.I.C

Food, MINISTRY OF. British government department responsible for controlling and distributing the nation's food. During the First Great War no attempt was made to control food consumption until Dec., 1916, when a food controller was appointed; the main energies of his department were at first devoted to exhortation. The success of the U-boat campaign necessitated sterner measures. Lord Rhondda took office as food controller in the following June. District food offices closed at the end of 1920, the ministry of Food in March, 1921.

A new ministry of Food was formed on Sept. 8, 1939, out of a department which had been operating since 1936. The first minister was W. S. Morrison; Lord Woolton's administration, April 3, 1940, until Nov., 1943, placed the ministry on a sound basis.

The ministry, whose powers were derived from the defence regulations, operated, wherever possible, with or through existing traders, but maintained a network of local offices. Its functions were to ensure adequate supplies of foodstuffs, distribute them equitably, and control prices. In addition to the purchasing and distribution of foods for the general public, the ministry's work included the administration of a welfare food service to expectant mothers and children under 5. The ministry was wound up, and its residuary duties were taken over by the ministry of Agriculture and Fisheries, in 1956.

Food and Agriculture Organization. Name of a subsidiary body of the United Nations. Based on plans drawn up at the Hot Springs Conference (*q.v.*) of 1943 on world food supplies and distribution, it was inaugurated at Quebec, Oct., 1945, 42 nations participating, and was the first of the permanent international organizations within the framework of the United Nations to come into existence. The Soviet Union, the Ukraine, White Russia, and Argentina, though represented by observers at the conference, decided not to participate in the organization. Its objects were to procure and coordinate information about agriculture and available food supplies in all member countries, to assist in the fair

distribution of such supplies, and, ultimately, to advise on crops needed, agricultural methods, etc., with a view to securing the best possible standard of nutrition for all the peoples of the world. Sir John Boyd Orr (Lord Boyd Orr), British expert on nutrition, professor of agriculture at Aberdeen university, was first director-general, 1945-48.

In 1947 the F.A.O. set up a permanent council whose chief duty was to keep under continuous review the world food situation and advise on emergency measures. Permanent headquarters of the body were opened in Rome in 1951.

Food and Drugs Act. Title of several enactments of the British house of commons passed to ensure the maintenance of a prescribed standard of purity, composition, and soundness of food and drugs offered for sale in Great Britain. Earlier legislation of this kind was consolidated in the Food and Drugs Act of 1938. See Food, Inspection of.

Food Chains. A term used in ecology. Animals eat plants; plants, using the energy of the sunlight, produce food from dead substances. This fundamental difference between plants and animals is the fact round which are built not only the relations between plants and animals, but also between many groups of animals. One kind of animal may, instead of eating plants directly, interpose another kind of animal between itself and the plant. A man eats a sheep which has eaten grass; the relation man-sheep-grass is then a food chain three links long. In the sea extremely long and complicated chains and indeed networks develop involving numbers of kinds of animals.

Food Control. Organization of supplies and equitable distribution of essential foods. Food control as currently understood was a product of the First Great War. The Allied blockade forced the German and Austrian governments to organize collection from producers and control distribution, while in Great Britain the loss of E. European supplies and the submarine campaign made it vital to plan imports. Lord Devonport, appointed food controller at Christmas, 1916, was succeeded in the following June by Lord Rhondda. The principles on which he worked were: (1) securing essential bulk supplies, if necessary by government purchasing, *e.g.* of meat and dairy produce from the dominions; (2)

giving priority of tonnage for essential foods; (3) fixing maximum prices at each stage of selling; (4) eliminating speculators. Given control of supplies and prices at the source, distribution could be left to traders, licensed, and sometimes specifically organized, for the purpose.

Control of Supplies and Prices

During the Second Great War nearly every country in the world was forced to adopt some measure of control based on bulk supplies, maximum prices, and a more or less flexible system of rationing. Food control in the U.K., although not complete, for bread and potatoes remained unrationed, was generally considered one of the best worked out and enforced. Thanks to the work of the Food (Defence) Plans department, established in 1936, the machinery was ready to be set in motion when war broke out. When supplies from the Far East had been cut off and shipping lanes lay exposed to attack from Europe, supplies, distribution, prices, and consumption had to be subjected to controls of severity never contemplated before the war.

PRODUCTION. Domestic agriculture was required to yield the maximum for direct human consumption while replacing as far as possible the feeding stuffs, fruit, eggs, etc., which virtually ceased to be imported owing to limited shipping space. County war agricultural executive committees were set up. By price inducements and direct controls, the arable acreage was increased by half, the potato acreage doubled, wheat output trebled, and vegetable production on farms and allotments increased many times. Farmers were encouraged to become self-sufficient in feeding stuffs. Nevertheless, serious reductions occurred in livestock populations, and it was decided that dairy cows should have first claim on available feeding-stuffs. Milk and millable grains were reserved for direct human consumption, and sheep and poultry populations declined by a quarter and the pig population by more than half.

IMPORTS. The government took control of imports of staple foods and of all food stocks in the country and in British hands abroad. Control was virtually complete in March, 1940. For all chief foods the ministry of Food became the sole importer. Bulk purchases were made from overseas exporters; exportable surpluses were sometimes purchased in advance,

especially from the colonies. Food missions were established in several countries, while as a member of the Combined Food board, the U.K. helped to plan the allocation of world supplies of scarce foods, itself buying on behalf of the board in certain markets. It was possible to supplement home production with foods economical in shipping space, *e.g.* livestock products, and dried goods.

DISTRIBUTION. The government aimed at securing maximum supplies for its controlled channels of distribution, and price structures and marketing systems were devised to this end. Eggs were bought from poultry keepers by licensed packing stations at a higher price than could legally be charged for a retail sale. Farm to farm sale of all grain was prohibited. Fat stock, sheep, and pigs could be sold only to the ministry, while apart from direct off-farm sales, all milk passed via the Milk Marketing board to the ministry. For all important foods, channels of trade were laid down and the ministry assured control by licensing pre-war traders.

Allocating Raw Materials

Various methods were used for controlling supplies, transport, and nutritional standards in the food-processing industries. Flour was never state owned although control of the mills fell little short of state management. Sometimes the government owned both the raw materials and the finished products; or it managed the plant direct, as in vegetable dehydration factories. In allocating scarce raw materials like sugar, oils, and fats, the claims of industry had to be balanced against direct consumer demand. For instance, use of millable grains and the composition of national bread were determined by the government in the light of changes in the general grain position. For most foods, retailers registered for supplies on the basis of consumer demand with licensed wholesalers who were mainly established traders. The wholesaler then registered with the first-hand distributor on the basis of his retailers' demand. The country was divided into nineteen divisions and some 1,300 local food control areas, within which retailers' allocations were easily matched with consumer demands, thanks to ration documents and registration.

PRICES CONTROL. "Standstill" orders which at the outbreak of war froze the prices of staple foods at their current levels were

soon replaced by specific price orders for individual foods. Price control secured a fair share of food for all consumers, prevented inflation and profiteering. Maximum prices and profit margins were fixed for all stages of distribution. For some agricultural commodities there were also minimum prices to encourage production. Where necessary, the prices of staple foods were kept down by subsidies from the exchequer. By 1943, 95 p.c. of the average household's outlay on food was on controlled commodities.

CONSUMPTION. By the end of 1943 essential foods were rationed in specific guaranteed amounts, most other foods on the points and personal points rationing schemes which allowed freedom of choice. Milk, eggs, and oranges were subject to controlled distribution, but potatoes and bread remained unrationed throughout the war, rationing of bread being introduced only on July 21, 1946. Extra allowances were provided for children, expectant and nursing mothers, invalids, and workers unable to use canteens. Supplies to catering establishments were controlled according to the number of meals served, to meet the requirements of floating populations. No ration coupons had to be given up for meals, but these were limited to three courses, with a maximum price of 5s. except in certain restaurants which were allowed to charge in addition a "house charge" varying from a few pence to 2s. 6d. according to their status. The provision of works and school canteens was encouraged, and support was given to local authorities setting up British Restaurants (*q.v.*) for the public.

Unfamiliar Foods

Food control brought some innovations for the consumer. To keep up nutritional standards, unfamiliar foods like dried egg and soya flour were distributed. Diet contained higher extraction bread and more vegetables. The advisory and publicity services of the ministry had to explain the necessity for such changes to the public. Vulnerable groups were given priority, even subsidised, in supplies of milk and vitamins. The prescription of minimum standards of composition for many foods and the regulation of labelling and advertising were other aspects of food control.

Food Preservation. Methods of keeping food edible beyond the time when decomposition would

take place if it were left untreated. Preservation of food depends on the inhibition of decomposition by bacteria, moulds, and yeasts, collectively termed micro-organisms, of the organic matter composing foods. It is the object of the food preserver so to treat his products that either the micro-organisms are killed or their development is arrested.

Salting and smoking are methods of great antiquity, and are used in particular for meat and fish, which may be packed in salt or, after brining, may also be smoked by exposure to the smoke of smouldering wood. In canning, all putrefactive organisms are destroyed by heat after the food has been enclosed in hermetically sealed containers.

Pasteurised Milk

Milk is pasteurised, by two main methods: (1) by the "holder" method it is heated to 138-150° F. and kept at this temperature for 30 minutes; (2) by the high-temperature-short-time process, it is heated for 15-20 seconds to 159.8°-162°F. In both methods the milk is rapidly cooled after heating.

Refrigeration reduces the temperature of food to the point at which no growth of micro-organisms is possible, and as long as this low temperature is maintained, the food will keep. (*See Cold Storage.*)

A recent development of food refrigeration is "quick freezing"; this involves literally the quick freezing, particularly, of fruit and vegetables, as a result of which, when thawed out, they approximate to the quality of the fresh gathered product.

When most of the moisture is removed from a foodstuff (dehydration) and it is thereafter kept dry, micro-organisms have no power to decompose it. Vegetables, particularly potatoes, lend themselves to this treatment. Fruit and fruit pulp can be preserved by sulphur dioxide. Sugar is the preservative in jam (combined with reduction of moisture). Spices have a preservative effect, owing to their essential oil content. Pickles are preserved by brining and fermentation during which lactic acid is produced.

The use of chemical preservatives is prohibited in several countries and limited in Great Britain where, under the regulations of the ministry of Health, the only preservatives allowed are sulphurous acid and benzoic acid.

Preservatives are permitted only in the following food and drinks: sausages, jam, dried fruits, fruit and fruit pulp, beer, cider, fruit juices, alcoholic and non-alcoholic wines and cordials, sweetened mineral waters, crystallised glacé or cured fruit, sugar, cornflour, corn syrup, gelatine, brewed ginger



Fool. The court fool of ancient time attired in his motley
After A. Lambron

beer, coffee extract, and pickles and sauces made from fruits or vegetables. See Canning; Refrigeration.

Food Storage. Biological term for the reservation of food for use later when demand exceeds supply. The process is a biological necessity, induced by the lack of conformity between the variations in availability of food and the need for it. Accumulation outside the organism may be the result of anticipation of events, as in human societies, or of instinctive behaviour, as in storage of honey by bees and nuts by squirrels. Alternatively, food may be deposited within an organism by virtue of the physiological tendencies of its cells; this occurs when excess sugar in photosynthesising cells of plants is converted into assimilation starch. Food storage serves in this instance, and in the conversion of sugar into glycogen in the mammal liver, to level down transitory intermittent maxima of concentrations of soluble food so that the stored material may be reconverted during intervening periods to build up concentration. Food stores may provide for the requirements of an organism during dormancy, e.g. the accumulations in the fat bodies in frogs and

hibernating insects. Reserves are laid down in stems and roots of woody perennial plants and in the rhizomes, tubers, corms, bulbs, etc., of others. They are provided in seeds, eggs, and comparable reproductive structures whenever the individual destined to develop from these is not nourished directly by the parent organism.

Fool (Lat. *foliis*, wind-bag). Retainer kept in the medieval period, and up to the 17th century, by kings and nobles for their entertainment. He was licensed in the exercise of his antic buffoonery, his fooling and the shrewdness of his tongue, and is scarcely to be differentiated from the jester. The fool wore a special parti-coloured dress, and a cap shaped like a cock's comb with ass's ears, and carried a mock sceptre with a fool's head carved on it, and a bladder at the end of a string.

Fools, FEAST OF. Medieval burlesque religious festival. A survival of the Roman Saturnalia (q.v.), it was originally celebrated on the first day of the year. The Church, although originally opposed to it, eventually allotted special days for its observance. The chief characteristic was at first the inversion of rank. A boy or young man, known by such names as the boy bishop (q.v.) or the abbot of unreason (q.v.), was chosen to conduct the ritual; but the ceremonies quickly degenerated into buffoonery.

The ass, representing Balaam's ass, the ass which stood by the manger, that on which the Virgin and Child fled to Egypt, or that on which Christ rode into Jerusalem, often played a part. In some places there was a special Feast of the Ass, e.g. at Beauvais, where the flight into Egypt was represented by a girl carrying a baby or doll and mounted on an ass, and the priest dismissed the congregation by braying three times, the people responding in the same fashion. The Feast of Fools survived until the Reformation, and as late as 1644 at Antibes in France.

Foolscap. Properly, the cap worn by fools and jesters, usually conical in shape with bells fastened to it. It is also the common name for a sheet of paper, strictly 17 ins. by 13½ ins., but frequently smaller. This is so called because it had formerly a fool's cap and bells for its watermark.

Fool's Parsley (*Aethusa cynapium*). Annual herb of the family Umbelliferae. It is a native of Europe and Siberia, growing chiefly in cultivated ground. It

has a spindle-shaped root and a smooth stem about 2 ft. high. The large, wedge-shaped leaves are much divided into small, thin segments. The minute white

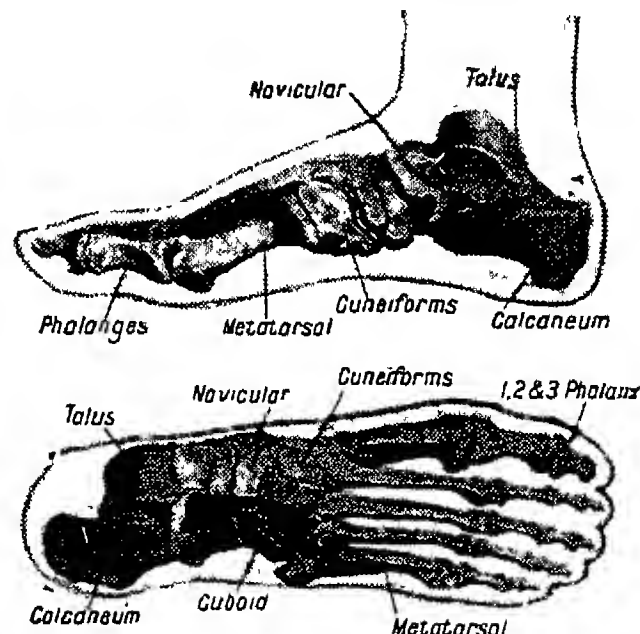


Fool's Parsley,
Aethusa cynapium

flowers are massed in compound umbels. Though somewhat like parsley, it is considered that its nauseous odour would prevent any but "a fool" from being imposed upon by the resemblance.

Foot. Lower extremity of the leg on which man stands or walks. The bones fall into three groups: (1) seven forming the tarsus or posterior part of the foot, which correspond to the bones of the wrist; (2) the five metatarsal bones; and (3) the fourteen phalanges, forming the toes. The tarsus consists of the calcaneum, which is the largest bone of the foot and forms the heel; the talus, which articulates with the tibia and fibula, the two smaller bones of the leg, to form the ankle joint; and five smaller bones—the navicular, three cuneiform bones, and the cuboid bone. The metatarsal bones are elongated, and articulate behind with the tarsus and in front with the phalanges.

The phalanges are fourteen in number, three in each of the four outer toes and two in the big toe. The foot is arched in the centre, the posterior pier of the arch being formed by the heel and the anterior by the heads of the metatarsal bones. The dropping of the longitudinal arch produces the condition called flat foot (q.v.). The dropping of the transverse arch allows the heads of the metatarsal bones to crush the nerves of the



Foot. Diagram showing the bones of the human foot, seen from the side and from above

part, causing intense pain. Treatment is by exercises to strengthen the muscles responsible for the integrity of the arch and by aids placed in the shoe. Club foot or talipes is a deformity which may be present at birth or acquired during later life. In talipes equinus the heel is drawn up and the patient walks on his toes. In talipes calcaneum the toes are raised from the ground. In talipes varus the foot is inverted, the inner side of the foot being raised, and the patient walking mainly on the outer side. In talipes valgus the foot is everted, and the patient walks on the inner side. These deformities may be more or less corrected by massage, manipulation, the use of suitable splints or other apparatus, forcible wrenching, and in some cases operation. In claw foot, or pes cavus, there is an increased concavity in the arch of the foot.

Foot. One of the oldest and commonest measures of length, based upon that of a man's foot, traditionally the king's. The English statute foot is divided into 12 ins. In prosody, foot is the term applied to a group of syllables, one of which is stressed to mark the rhythm forming a part of a verse.

Foot. Name of a British family of politicians. Isaac (b. 1880), a solicitor in Plymouth, represented Bodmin as Liberal M.P. 1922-24 and 1929-35. He was secretary of Mines in the National government, 1931-32, lord mayor of Plymouth 1945-46, and in 1947 became president of the Liberal party organization.

His son Dingle Mackintosh (b. 1905) was educated at Bembridge school and Balliol College, Oxford. Called to the bar in 1930, he took silk in 1954. He was Liberal M.P. for Dundee 1931-45, and chairman of the Observer trust 1953-55; Labour M.P. for Ipswich from 1957. Another son, Michael (b. 1913), educated at Wadham College, Oxford, joined the Evening Standard 1938, and was acting editor 1942. He became a Daily Herald columnist 1944, joint editor of Tribune 1948. Under the pseudonym Cassius he wrote political pamphlets. He was returned as Labour M.P. for Devonport, 1945. A third son, Hugh Mackintosh (b. 1907), knighted 1951, G.C.M.G. 1957, was governor of Jamaica 1951-57, of Cyprus from 1957.

Foot - and - Mouth Disease. Fever affecting cattle, sheep, pigs; other animals, including man, are liable. In Great Britain, it is

the result of imported infection. When there is an outbreak, the district in which it appears is isolated by forbidding the movement of cattle, sheep, etc., in or out of it, and affected animals are slaughtered and the bodies burned, compensation being paid by the government.

It is highly contagious, the virus, which can live for four weeks, being readily carried by soil, hair, or infected milk. In animals the virus gains entrance through the intestinal mucous

membrane, but in man it is more often the result of direct inoculation from the saliva of infected animals, or from milking cows with eruptions on the udders. As a rule adult animals are not fatally affected, but younger animals die. The incubation period is a few days, when a slight fever is accompanied by ulcers in the mouth and on the feet. A weak solution of permanganate of potash is a good local application. See Bacteriology.

FOOTBALL: ASSOCIATION AND RUGBY

George F. Allison and H. B. T. Wakelam

The two most popular winter games in the United Kingdom, with both players and spectators, are here described and their history told, the one by the former manager of the Arsenal F.C., the other by a well-known writer and radio sports commentator on Rugby

ASSOCIATION FOOTBALL. At the beginning of the 20th century, it was justifiable to refer to Association football as an English game. Forty years later, it was played in nearly every country in the world, taking hold even in America. Instead of showing others how to play, British teams had to struggle grimly against those of other countries.

Football is still an English game, however, in the sense that it had its origin in England. It survived despite royal edicts forbidding the people to play "such an impertinent game." Historians of the 13th century record that "annually on Shrove Tuesday, London schoolboys went into the fields immediately after dinner to play at the celebrated game of ball."

Forbidden by Law

Its popularity grew, and in 1349 Edward III forbade it by law. Again, in 1389, Richard II passed an Act for the purpose of encouraging shooting, and forbade throughout the kingdom "all playinge at tennis, footballe," and various other games. In 1401, Henry IV repeated the embargo. In 1458 James III of Scotland decreed that "footballe and golfe be utterly put down." This football, of course, was not of the organized kind of today—in some matches between rival villages, the goals were two or three miles apart and the contests went on from two o'clock to sunset.

To the schools of Westminster and Charterhouse belongs the major share of the credit for the origin of the rules governing the association code, though other public schools played football in various forms, some of them differing only in minor degree.

The Football Association of England, supreme authority of the game, came into being at a meet-

ing held in London in October 1863. At the beginning of the season 1866-67 only ten clubs were affiliated to it. The first organized football club in England was one formed in Sheffield in 1857; not until 1866 was the first inter-city match played in Battersea park between London and Sheffield.

In 1867 the now famous amateur Scottish club, Queen's Park, Glasgow, was started by a few young enthusiasts. This club built for itself a marvellous arena, Hampden Park, the largest in the British Isles, where the England v. Scotland international match takes place every two years. The attendances at these matches have on occasion neared 150,000.

In 1871 the association passed the following simple resolution: "That a challenge cup be established, open to all clubs belonging to the Football Association." The Association was virtually without funds, and the £25 needed to buy the unpretentious cup was provided by the clubs. Fifteen entered in the first year of the cup competition.

In 1872 the first real international match between U.K. countries was played in Scotland. Within the next few years the game had progressed so much that internationals between England, Scotland, Ireland, and Wales had become established.

Professionalism was officially sanctioned in the year 1885. In 1888 the Football League came into being. At its outset it embraced 12 clubs—Preston North End, Wolverhampton Wanderers, Bolton Wanderers, Aston Villa, West Bromwich Albion, Everton, Derby County, Notts County, Burnley, Stoke, Accrington, and Blackburn Rovers.

There are now approximately 40,000 amateur clubs, and about

three-quarters of a million amateur players affiliated to the Football Association; while there are only about 400 clubs which engage professionals, to the round figure of 5,000. Probably two-thirds are part-time footballers.

Apart from the men who are paid to play, and salaried officials, money cannot be made out of football. The big professional clubs may not be run for personal profit. Some may show a big balance at the end of a successful year, but every penny must go back to the game in some form or another.

League and Cup Competitions

In the very first season in which there was both a league and a cup competition, Preston North End carried off both honours, winning the league competition without losing a match, and winning the cup without having a goal scored against it in the competition. It is unlikely that such a dual feat will ever be equalled, though Aston Villa won the cup and the league championship in the same season—in 1895.

The fact that the cup competition was open, at its inception, to any club affiliated to the Football Association accounted for the title Football Association challenge cup. It is now generally referred to as the English cup, despite the fact that Welsh clubs enter in goodly numbers, and that in 1927 the trophy was taken by a Welsh side, Cardiff City.

In the early days of the F.A. cup the final ties were played at Kennington Oval; and in 1876, '77, and '78, it was won by the Wanderers. According to the rule then obtaining, the trophy became the property of triple winners; the Wanderers handed it back to the organizers, however, and it remained as *the* cup, never to be won outright. But it was stolen from a Birmingham shop window in 1895, while on show after an Aston Villa victory. Nobody, except the thieves, knows what happened to the precious piece of silver. Another cup was provided at a cost of £25, and this remained the trophy until 1909. In that year it was won by Manchester United, whose officials ordered an exact replica for boardroom decoration. The Football Association decided that this was not right. They ordered a new cup, at a cost of £50, copyrighted the design, and handed the previous trophy to Lord Kinaird, first president of the F.A., who had himself been in the winning side five times.

Immediately after the First Great War, finals were played on a club ground—that of Chelsea; but in 1923 Wembley was chosen for the final, and the biggest crowd which has ever assembled for any game turned out to see Bolton Wanderers play West Ham United. The gates of the ground were rushed, and tens of thousands hustled through without paying, to take up positions on the actual playing pitch. That scene brought a new cup final era—admission by ticket only, with the tickets limited to a trifle less than one hundred thousand. It is no unusual thing for cup final ticket applications to number over half a million. (See Association Cup.)

From the original twelve, the Football League gradually grew in numbers, and in 1892 a second division was formed. For a short while promotion from and relegation to this second division was decided by test matches, played at the end of each season, between the lowest pair of the top class and the leading pair of the second class. In due course, however, these test matches were abolished, and promotion for the two top clubs of the second division and relegation for the two lowest clubs in the first division at the end of each season became automatic.

League Organization

Football League membership increased to twenty-two per section immediately after the First Great War, and two new sections, southern third and northern third came into being, with automatic promotion and relegation; the 1950s brought further changes in organization. Starting with 1924, Huddersfield Town won the first division championship in three successive seasons, being the first club to do this. Arsenal equalled this feat in the 1933-34-35 seasons.

Much the same system, so far as promotion and relegation are concerned, was adopted in Scotland, with interruptions from time to time in the relegation and promotion regulations. Scotland also introduced an annual knockout cup competition very much on English lines, and, in 1946, a league cup competition.

On terms arranged between League clubs a player may be transferred from one to another, though no player can be transferred unless he is willing. If he does move, he can be paid only what is called presumed accrued share of the benefit money which he would have received from the transferring club if he had stayed

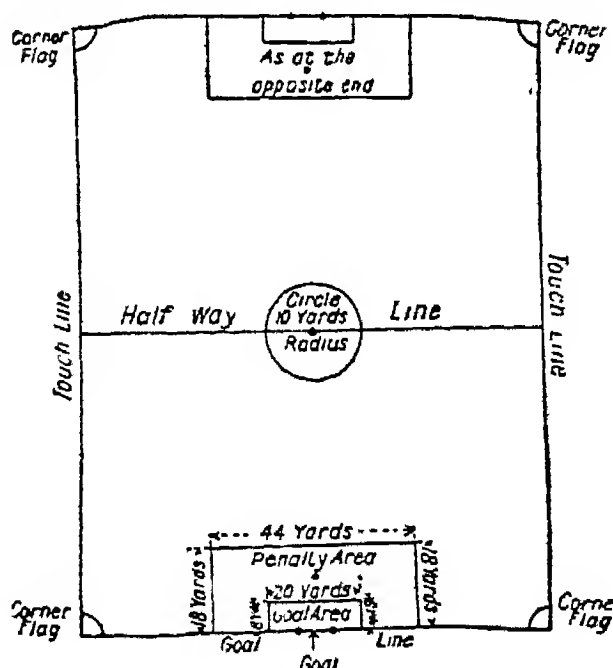
for the qualifying five-year period. As there are maximum wage rules no player is better off financially so far as direct remuneration for playing the game is concerned, by changing from one club to another.

A player is eligible to play in league games immediately his signing for the club has been registered, but his signing must have been registered for 14 days before a player may play in the F.A. cup competition; and in the latter competition a player is not allowed to play for more than one club in any one season.

Transfer Fees

In 1905 Middlesbrough paid the first £1,000 fee to secure the services from Sunderland of Alf Common. Since then the fees paid for star players steadily increased; £10,890 for David Jack (1928); £20,000 for Tommy Lawton (1947); £26,000 for Eddie Quigley (1949); £30,000 for Trevor Ford (1950); £34,000 for J. Sewell (1951). Attempts to limit transfer fees have been made from time to time. No part of the fee is paid to the footballer himself; although in 1957 it was proposed that a transferred player should receive a percentage of the fee.

ASSOCIATION RULES. The game is played on a ground marked as shown below. The circumference



Football. Diagram showing lines and dimensions of Association football ground

of the ball must not be more than 28 ins. nor less than 27 ins. The weight at the start of the game must not be more than 16 oz. nor less than 14 oz.

The game is played by two teams, each consisting of not more than 11 players, one of whom is the goalkeeper. One of the other players may change places with the goalkeeper during the match, provided notice be given to the referee before such change is made. Apart from the goalkeeper, a team can be made up



Football. The Association game. 1. Scoring a goal. 2. Breasting. 3. Heading. 4. Dribbling down the wing. 5. Goalkeeper saving a good shot. 6. Over-head clearance. 7. A throw-in. 8. Combination. 9. Punching clear

in any way in the positional sense. A goalkeeper must wear distinctive colours, and no player may wear anything which is dangerous to another player.

The appointed referee must enforce the laws and decide any disputed point. His decision on points of fact connected with the play must be final so far as the result of the game is concerned. His jurisdiction begins from the time he signals the kick-off, and his power of penalising extends to offences committed when play has been temporarily suspended, or when the ball is out of play. He must, however, refrain from penalising in cases where he is satisfied that by doing so he would be giving an advantage to the offending team. Two linesmen should also be appointed, whose duty (subject to the decision of the referee) is to indicate when the

ball is out of play, and which side is entitled to the corner-kick, goal-kick, or throw-in.

The duration of the game is two equal periods of 45 minutes unless otherwise mutually agreed upon, subject to allowances being made in either period for all time lost through accident or other cause, the amount of which is a matter for the discretion of the referee; and that time must be extended to permit of a penalty-kick being taken at or after the expiration of the normal period.

At the beginning of the game, choice of ends and the kick-off is decided by the toss of a coin. The team winning the toss has the option of choice of ends or the kick-off. When re-starting after half-time, ends are changed and the kick-off taken by a player of the opposite team to that of the player who started the game.

The ball is out of play when it has wholly crossed the goal-line or touch-line, whether on the ground or in the air, and when the game has been stopped by the referee. A goal is scored when the whole of the ball has been properly propelled over the goal-line, between the goal-posts and under the cross-bar. The team scoring the greater number of goals during a game is the winner.

A player is off-side if he is nearer his opponents' goal-line than the ball at the moment the ball is played unless: (a) he is in his own half of the field of play; (b) there are two opponents nearer to their own goal-line than he is; (c) the ball last touched an opponent or was last played by him; (d) he receives the ball direct from a goal kick, a corner kick, a throw-in, or when it is dropped by the referee. (It is not an offence for a player to be in an off-side position. He can be off-side only if interfering with the play of an opponent or seeking to gain an advantage.)

Rules Relating to Penalties

A player is penalised if he intentionally: (a) kicks, strikes, or jumps at an opponent; (b) trips, including throwing or attempting to throw, an opponent by use of the legs, or by stooping in front or behind him; (c) handles the ball, i.e. carries, strikes, or propels it with the hand or arm (this does not apply to the goalkeeper within his own penalty area).

There are several other offences, some punishable by free kicks from which goals may be scored direct, and others by indirect free kicks, from which goals can be scored only if the ball is touched by a second player. Most offences by defenders, in the penalty area, are punished by the award of a penalty kick, during the taking of which all players, except the kicker and the goalkeeper, must stand outside the penalty area, and outside the arc of the circle. The goalkeeper must stand, not moving his feet, under the cross-bar, until the ball is kicked from the penalty spot. When free kicks are taken all opposing players must stand at least ten yards from the ball, unless they are on their own goal-line between the goal-posts. A player taking a free kick or a corner kick must not play the ball a second time until it has been played by another player.

When the whole of the ball passes over a touch-line, either on the ground or in the air, it is thrown in from the point where it crossed the

line, in any direction, by a player of the team opposite to that of the player who last touched it. If the ball is improperly thrown in, the throw-in shall be taken by a player of the opposing team. When the whole of the ball passes over the goal-line, excluding that portion between the goal-posts, either in the air or on the ground, having last been played by one of the attacking team, it is kicked direct into play beyond the penalty area by a player of the defending team. If the ball is not kicked beyond the penalty area, *i.e.* direct into play, the kick shall be retaken. If a player taking a goal kick plays the ball a second time after it has passed beyond the penalty area, but before it has touched or been played by another player, an indirect free kick is awarded to the opposing team, to be taken from the place where the infringement occurred.

When the whole of the ball passes over the goal-line, excluding that portion between the goal-posts, having last been played by one of the defending team, a member of the attacking team takes a corner kick. A goal may be scored direct from such a kick.

George F. Allison
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RUGBY FOOTBALL. It is to one William Webb Ellis, a boy at Rugby School, who, in 1823, "first took the ball into his arms and ran," that the beginning of Rugby football is usually credited. Sixteen years later, Albert Pell, an old Rugbeian, introduced the game at Cambridge, where in 1848 a not very successful meeting of interested parties was held in an endeavour to frame a code of rules.

Developed by the Schools

Other schools were gradually adopting the Rugby game, notably Marlborough, an offshoot of Rugby, founded in 1843, and Cheltenham, which can claim to be the originator of the numerical scoring system, this being generally adopted in 1886. From the Old Boys' team of the now defunct Blackheath school, the old Blackheathens, there arose, in 1862, the Blackheath R.U.F.C., first acknowledged club in the game. Richmond followed in 1863 (the year of the first Blackheath *v.*



Football. The Rugby game. 1. Passing on being tackled. 2. Taking a pass. 3. A drop kick. 4. A tackle. 5. Scoring a try. 6. Place kicking. 7. A dash for a try. 8. Making a mark. 9. A scrum

Richmond match), and then came Manchester, Bath, Bradford, Liverpool, Harlequins (known as Hampstead until 1870), Wasps, and other formations. In 1869, Oxford University took up the game, and, in 1870, at Auckland, Rugby first appeared in New Zealand.

On Jan. 26, 1871, a red letter day, Blackheath, Richmond, Wellington College, Guy's Hospital, Harlequins, King's College, S. Paul's, Civil Service, Marlborough Nomads, Queen's House, West Kent, Wimbledon Hornets, Gypsies, Clapham Rovers, Flamingoes, Law, Lausanne, Addison, Mohicans, and Belsize Park met in London to found the Rugby Union. On March 27, 1871, came the first international, at Raeburn Place, Edinburgh, when Scotland beat England by one goal and one try to one try. Teams were then 20 a side—made up of 13 forwards,

three half-backs, one three-quarter and three full-backs.

In 1871-72 Oxford and Cambridge met for the first time, and, in 1873, the Scottish Union was formed, the Irish following in 1879, the Welsh in 1880.

In 1875 it was decided that should no goal be kicked, or should an equal number of goals be kicked by both sides, matches were to be decided by a majority of tries. Previously no match could be won unless a goal was actually kicked, unconverted tries not counting in the reckoning.

In the same year Oxford and Cambridge took the field 15 aside instead of 20, a step which was followed for internationals in 1877, the year of the birth of Rugby in France, and also that of the first Navy-Army match.

Gradually the game became more open and less of a rough-and-

tumble, a big improvement coming in 1881 when three three-quarters were first seen in international matches, but a bigger stride still was due to the Oxford sides of 1881-83 when the art of the half-back passing game was brought out by Alan Rotherham.

In 1885 Paris R.F.C., the first French team to cross the water, appeared against the Civil Service at Dulwich, but more important still was the introduction in the same season by the Cardiff club of the four three-quarter line-up, though this was not generally adopted until 1893-94.

First British Visit to Australasia

The first British touring team visited Australasia in 1888, a New Zealand side, known as the Maoris, paying a return visit the same year, and then, in 1890, the International Board was formed. This board nowadays consists of 10 representatives, four from the Rugby Union (never the "English" Rugby Union), and two each from the Scottish, Irish, and Welsh Rugby Unions.

To Rosslyn Park (founded in 1879) goes the honour of being the first club to make an official trip to France—in 1893, when it beat the Stade Français by three goals and three tries to nil.

For some time already there had been discussion concerning the payment of "broken time" to players, who, by force of circumstances, had to sacrifice pay to take off the time to travel to and take part in, matches. The Rugby Union considered the matter at a very long and spirited meeting, but the voting went against payment, the result being the so-called split and the formation of the Northern Union Football League (now the Rugby League), with its 13-a-side teams and its own code of playing laws.

In 1902 Canada sent over her first representatives to the U.K., and in the 1905-06 season came the first meeting of England and France. That season, too, new scoring values were adopted; and a New Zealand team under Dave Gallaher arrived in Britain, shaking up the home players and returning with a record of thirty-two wins against one defeat, and a score of 868 points to 47.

The visit of Paul Roos's South Africans of 1906-07 helped still more, and there followed the Adrian Stoop era in English Rugby. This farsighted genius of the game, first with his own club, the Harlequins, and then with the English fifteen, adopted and im-

proved a new style of play and for some years the Englishmen carried almost everything before them.

More spectacular play meant greater popularity amongst the watching public, and this led to the purchase, in 1907, of the Rugby Union ground at Twickenham, the first match there being played between Harlequins and Richmond on the first Saturday in Oct., 1909. The opening international was England v. Wales in Jan., 1910, England winning by eleven points to six and scoring direct from the kick-off. Stoop caught the ball from this kick and, after a short run, started a movement which finished in the scoring by F. E. Chapman of Westoe of the first Twickenham international try. Twickenham accommodates over 70,000 spectators.

After the 1914-1918 war, came a run of English successes, usually called the W. W. Wakefield era. It was chiefly remarkable for a very highly specialised type of fast and intelligent forward play in conjunction with one of the best pairs of half-backs the game has ever produced, C. A. Kershaw and W. J. A. Davies. C. G. Porter's New Zealanders arrived in 1924, played 30 matches and won them all. The same year the home countries under R. Cove-Smith, visited S. Africa, registering nine wins, nine losses, and three draws.

Seven-a-Side at Twickenham

In 1926 another New Zealand team, this time the Maoris, came over to win 22 of their 31 matches. That year, too, was the first in which the seven-a-sides were played at Twickenham. Also the laws of the game were redrafted.

After an Australian touring side, the "Waratahs," led by A. C. Wallace (winning 24, losing five, and drawing two) had paid the home countries a visit in 1927, D. J. MacMyn of Scotland captained a British side to the Argentine. Here they won all of their nine matches, scoring 295 points against nine. Then in 1930 another home touring party, captained by F. D. Prentice, went off to Australasia, winning 20 and losing eight matches.

In 1931-32 came the third South African visit, B. L. Osler captaining a side which relied almost entirely on a fine pack of forwards for its results. It achieved 23 wins and two draws, against only one loss, at Leicester, to the combined Leicester and East Midlands team.

In 1931 occurred the split with France, owing to a difference of

opinion somewhat similar to the 1893 dispute at home. Not until the opening months of the Second Great War was this disagreement finally resolved.

The first official trip to the U.S.A. was made in 1934, W. J. Leather taking over the Cambridge University team, which played four matches and won them all with ease, causing a sensation by speedy running and open methods.

Then in 1935-36 came yet another New Zealand trip to this country, J. E. Manchester leading a side which won 24 matches, drew one, and lost three, going down before Swansea, Wales, and England. To Swansea, the "All Whites," thus went the honour of being the first home club to defeat a New Zealand touring team.

The Calcutta Cup

In 1879 the original Calcutta Football club was disbanded, and to mark this occasion it presented a cup to the Rugby Union to be played for annually between England and Scotland, a game generally accepted as the greatest of the year. The famous Barbarian club came into existence in 1890. Since then it has gone from strength to strength, and to be a Barbarian, which can happen only by invitation, is the ambition of every player.

RUGBY UNION RULES. The game of Rugby is played between two teams of 15 a side. It is played with an oval ball, 11 to 11½ inches long, 24 to 25½ inches in circumference, and weighing 13½ to 15 ounces. Usually a 15 consist of eight forwards, two half-backs, four three-quarters, and a full-back, the last seven being known as the backs as opposed to the rest, the forwards. The normal line-up is as follows:

Full-back.

Right wing three-quarter.
Right centre three-quarter.
Left centre three-quarter.
Left wing three-quarter.

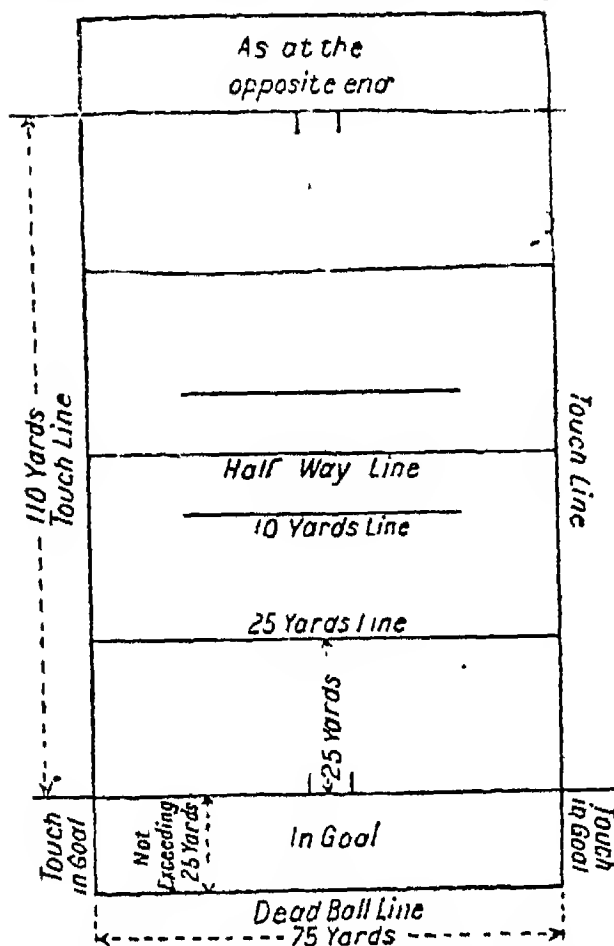
Stand-off (or outside) half.
Scrum (or inside) half.

3 { Flank front row forward.
Middle front row forward
("hooker").
2 { Flank front row forward.
Second row forward.
2 { Second row forward.
Outside back row forward
("winger").
3 { Middle back row forward.
Outside back row forward
("winger").

This gives the 3-2-3 "pack" of the forwards, though there is quite a common variation, 3-4-1. There is also an outside variation, emanating from New Zealand, in

which the outside half becomes the 1st five-eighth, and one of the centres the 2nd five-eighth, thus leaving only three three-quarters.

The game is played on a ground marked out as shown below, and is controlled by a



Football. Plan of Rugby football ground

referee, assisted by two "touch judges," whose duties include the marking by upraised arm and flag of the places where the ball, or player carrying it, crosses the touch-lines in the course of play. The referee is the sole timekeeper and judge of fact.

Duration of Play

Play is divided into two halves of not more than 40 minutes each, with a five-minute interval during which the teams change ends. The start of a game is known as the kick-off, the end as no-side. The run of play depends almost entirely upon the laws of on-side and off-side, a broad interpretation of these laws in Rugby being that a player must never be in front of the ball or of a member of his own side who is carrying it. For in Rugby football the use of both hands and feet is permitted. Including as it does the tackle and the scrummage, as well as open running and inter-passing of the ball from one player to another, it has been described as two kinds of game in one, for it allows for skill, tactics, and speed as well as actual physical contact of the players; and though there is a long and elaborate code of laws, much of the fairness and good feeling of the game depend upon unwritten law, and therefore upon the honesty and good sportsmanship of the individual player.

The primary object of the game is the scoring of a try, which is obtained when an attacking player first grounds the ball in his opponents' in-goal (see plan). This try can then be converted into a placed goal if any player in the attacking team kicks the ball by a so-called place kick over the opponents' cross-bar without its touching the ground or any player of either team. A goal is scored if the ball has crossed the bar, even though it may have been blown back afterwards, and whether it has touched the cross-bar or either goalpost or not. It is also a goal if the ball passes between the imaginary lines of vertical continuation of the goalposts.

Scoring Points

Other methods of scoring are the dropped goal, made when a player drop kicks the ball over the cross-bar during the run of play, the goal from a free kick (this is the "mark"), and the penalty goal. Either of these last two can be taken by means of a drop or a place kick. There is also the very rare "penalty try" awarded at the referee's discretion. The following are the point values:

A try	3 points
A goal from a try (in which case the try shall not count)	5 points
A goal from a free kick, or penalty kick (whether placed or dropped)	3 points
A dropped goal otherwise obtained	3 points

A place kick is made by kicking the ball after it has been placed on the ground for that purpose.

A drop kick is made when a player in possession of the ball lets it fall from his hand or hands to the ground, and kicks it at the first rebound as it rises.

A free kick is a kick allowed for a "fair catch."

A penalty kick is a kick awarded to the non-offending team by reason of the infringement of the laws by their opponents.

Both "free" and "penalty" kicks may be taken by place kick, drop kick, or "punt."

A punt is made when a player in possession of the ball lets it fall from his hand or hands, and kicks it before it touches the ground (no kind of a goal can be scored by this means).

A tackle occurs when the holder of the ball in the field of play is held by one or more players of the opposing team so that, while he is so held, there is a moment when he cannot pass or play the ball.

A scrummage, which can take place only in the field of play

(not in-goal) is formed by one or more players from each team closing round the ball when it is on the ground (this is the loose scrum); or by players of each team closing up in readiness to allow the ball to be put on the ground between them, in accordance with the particular law of the game. This is the "set" or "tight" scrum in which the forwards "pack" down in 3-2-3 or other similar formation. It is the method of restarting the game after non-penal offences, and is perhaps the main feature of Rugby football.

A "line-out" restarts the game after the ball has gone into touch.

H. B. T. Wakelam

THE RUGBY LEAGUE (Northern Union from 1895 to 1922) controls the professional game, particularly popular in Yorkshire, Lancashire, and S. Wales. Test matches are played against Australia and New Zealand.

During the Second Great War, League players were allowed to play alongside R.U. amateurs in services matches, but the two codes afterwards separated again, with London seeing League players only once a year—at the R.L. challenge cup final, played since 1929 (with one exception) at Wembley stadium. The league championship resembles that of the Association Football League.

The rules of the Rugby League include the following differences from the amateur game: there are only 13 players a side (including 6 forwards); only 2 points are scored for any kind of goal (in addition to 3 for a try, as in the Rugby Union); a scrummage is taken if the ball crosses the touch-line, a direct kick to touch (except a penalty kick) being followed by a "scrum back" at the spot where it was kicked; the ball must be immediately heeled back after a tackle.

AMERICAN RUGBY, known in the U.S.A. as football, derives from the Rugby Union game. There are 11 players a side, their object being to achieve a touch-down over their opponents' goal-line. The playing field, including end zones, is 360 ft. long and 160 ft. wide; the actual field of play is divided into twenty 5-yd. sections giving rise to the "grid-iron" pattern. The play, both on the attack and on the defensive, is controlled by signals, definite formations being adopted.

THE AUSTRALIAN GAME originated at Melbourne in 1858. The ball is oval; there are 18 players a side (with no goalkeepers); and

the game is played on an oval ground 150 to 200 yds. long by 120 to 170 yds. wide. The goal-posts, 20 ft. high, with no crossbars, are placed seven yards apart, and seven yards outside each of them stands a behind-post. A goal (six points) is scored by kicking the ball between the goal-posts, a "behind" (1 point) by kicking it between the behind-posts. The ball may be kicked, punched, or "handballed"—that is, punched off the hand. It may not be thrown, nor may it be carried more than 10 yds. without being bounced on the ground. Tackling is allowed, under strict rules. There is no offside rule. The match is controlled by a field umpire, assisted by two boundary umpires and two goal umpires. It lasts 100 mins., divided into four quarters, with a 15-min. break after the second quarter. Ends are changed each quarter. Injured men are at once replaced by reserves.

Football Association. Governing body of English amateur and professional association football. It was founded in 1863 to establish a definite set of rules to govern both Rugby and Association football, but at a preliminary meeting the representatives of the Rugby clubs objected to the proposal to make hacking illegal, and withdrew. The F.A. was formed into a limited liability company in 1903. Its council includes a president, six vice-presidents, hon. treasurer, ten divisional representatives, eight representatives of the Football League, and one of each affiliated association with membership of at least 50 clubs.

Football League. Union of Association football clubs for the purpose of playing matches against one another. The main principle is that every club in a league shall play every other club twice during the football season, once at home and once away. The idea was borrowed from the U.S.A., where it was practised by baseball clubs, and was suggested by W. McGregor of Birmingham in 1888.

Football Pool. Competition in which prizes are offered for forecasting correctly the results of League football matches in Great Britain. During 1939-45 coupons were printed in newspapers and weekly magazines; a legal decision in 1945 declared illegal the advertising of football pools in newspapers, and coupons were then sent to clients by post. Nearly all promoters offer two types of competition: (1) involving the selection of a given number of results from a

long list of matches, minimum stake usually 6d., maximum £1; dividends calculated by dividing the amount of the stake money, less the promoter's commission and expenses, by the number of correct, or most nearly correct, forecasts; (2) the "penny points" pool, in which a forecast has to be made of the results of, say, 12 or 15 matches. Stakes are a penny per forecast, and winners are determined by the addition of points, one for a home win, two for an away win, three for a draw.

Pools were started in a small way in 1923, but developed rapidly after the Betting and Lotteries Act of 1934 clarified the legal status of off-the-course betting, and some dozen firms formed the Football Pools Promoters' Association. In 1935-36 it was estimated that the average number of weekly subscribers was about 3,800,000, the aggregate stakes received being about £20,000,000. By the mid-1950s total annual expenditure by some 16,000,000 subscribers had risen to £68,000,000. Revenue running into several million accrued to the post office, from postage and poundage on postal orders. A 20 p.c. duty was imposed on stake money in 1948. Advertising of football pools was legalised in 1954.

Foot Drop. Condition in which the extensor muscles of the toes and the dorsi-flexor muscles of the ankles lose their power owing to poisoning from alcohol, lead, or arsenic, or to shortage of Vitamin B₂ as in beri-beri. The dropping of the foot necessitates high stepping to clear the ground.

Footie, SAMUEL (1720-77). English actor and dramatist. Born at Truro, Jan. 27, 1720, he was edu-



Samuel Foote,
English dramatist
After Joshua Reynolds

cated at Worcester College, Oxford, but gave up a legal career to go on the stage. He was a brilliant mimic and brought out at The Haymarket in 1747 a successful entertainment called *The Diversions of the Morning*, in which he burlesqued well-known living persons. The magistrates having prohibited its performance, he defied them by issuing a general invitation to his friends to "take a dish of tea with him"—by ticket. With *The Haymarket*, rebuilt by him in 1767, Foote remained connected till

1777, producing there several of his caricature comedies, the best of which are *Taste*, *The Minor*, *The Orators*, *The Mayor of Garratt*, *The Devil upon Two Sticks*, and *The Capuchin*. He died suddenly at Dover, Oct. 21, 1777, and was buried in Westminster Abbey.

Footpath. Narrow path used by pedestrians over which there is a public right of way. In the U.K. the right has usually arisen from some Act of parliament or from dedication of the land by some owner. Dedication may be by deed but usually will be inferred from long use. If a path has been used for 20 years as of right without interruption, dedication will be presumed in the absence of evidence (e.g. notices that a path is not a right of way placed near it by the owner) that there was no such intention, or evidence that no one able to dedicate was in possession of the land. After 40 years, dedication is conclusively presumed in the absence of evidence that there was no such intention. In a rural parish the council may repair all footpaths other than those beside a public road. The National Parks and Access to the Countryside Act, 1949, laid on every co. in England and Wales the duty to survey, and publish maps of, all footpaths and bridleways within its area. See *Right of Way*.

Footplate. Metal plate on a locomotive which covers the floor where the driver stands, and extends along both sides of the engine and in front of the boiler. It is also a metal floor-plate secured to the end of a railway corridor carriage, which rests and is free to slide upon the end of the next carriage, to form a gangway. See *Steam Engine*.

Foot-pound. Work done when a force of one pound weight moves through a distance of one foot parallel to its line of action. See *Horse-power*.

Foot Rot. Term usually applied to a disease affecting the feet of sheep. The animal suffers great pain from an acute inflammation of certain structures of the foot, caused by a microscopic organism which infests low and damp pastures. The disease is readily noticed, for infected animals adopt a kneeling position when grazing.

Affected animals must be removed at once to a dry yard or shed. Dryness is absolutely essential, and if the animals are allowed to stand for a short time daily on a floor covered with slaked lime, the healing process is considerably hastened. Foot rot is highly contagious, and since it takes three

weeks to develop, newly purchased sheep should be kept apart from the rest for 20-30 days.

Forage. Name for coarse fodder crops, like straw, as distinguished from green and succulent fodder crops. See Fodder.

Forain, JEAN LOUIS (1852-1931). French painter. Born at Reims, Oct. 23, 1852, he studied under Gérôme at the Beaux Arts. After contributing to *Le Monde Parisien*, *Charivari*, *Figaro*, *La Vie Parisienne*, etc., he expressed his satirical talent at its best in *Le Courrier Français* and *Le Rire*, and later in the *Psst!*, an anti-Dreyfusard sheet founded by himself and Caran d'Ache. He was above all the interpreter and castigator, in exquisite draughtsmanship, of the seamy side of Paris life, of conventions and methods of jurisprudence. Two of his most biting satires, *The Law Courts* and *The Tribunal*, are in the Tate Gallery. After the First Great War he went into retirement and painted still life, but his technique as an engraver gave an element of sharpness to his compositions. He died at La Chesnay, July 11, 1931.

Foraminifera (Lat. *foramen*, small hole). Minute creatures belonging to the sub-kingdom Protozoa. Many of them are scarcely visible to the naked eye. Most of them are marine. They secrete a limy or membranous shell, usually perforated with minute holes through which thread-like processes of the body protoplasm can be extruded. With the aid of these pseudopodia (false feet) the animal is able to creep about and to secure the particles of organic matter on which it feeds. The ooze of the ocean beds, and the vast deposits of limestone which form so large a portion of the earth's crust, are largely composed of the dead shells of foraminifera.

Forbes, ALEXANDER PENROSE (1817-75). British divine. Born at Edinburgh, June 6, 1817, and educated there and at Glasgow, in 1836 he entered the Indian civil service. His health failing, he returned to England and won a Sanskrit scholarship at Brasenose College, Oxford. Ordained in 1844, he was appointed bishop of Brechin in 1848, but moved the centre of his diocese to Dundee, where he built the pro-cathedral. A prominent high churchman, he was tried in the ecclesiastical courts on a charge of heresy, arising out of the statement of his views on the Eucharist contained in his primary charge, and was censured. He died in Dundee, Oct. 8, 1875.

Forbes, ARCHIBALD (1838-1900). British war correspondent. Born in Elginshire (now Morayshire), April 17, 1838, and educated at King's College, Aberdeen, he left the university to enlist in the Royal Dragoons, and, while still a trooper, contributed articles to the papers. In the Franco-



Archibald Forbes
British war
correspondent

Prussian War of 1870-71 he made his reputation as correspondent, first of the *Morning Advertiser* and then of the *Daily News*. He reported on the Russo-Turkish and Zulu Wars, being able in the latter to give Great Britain the first news of the battle of Ulundi, 1879. He wrote *Memories and Studies of War and Peace*, 1895. Died March 30, 1900.

Forbes, DUNCAN (1685-1747). Scottish lawyer. Born near Inverness, Nov. 10, 1685, he studied law at Leyden, was admitted advocate and appointed sheriff of Midlothian in 1709, and, for his services in suppressing the rebellion of 1715, was made deputy-advocate. Returned to parliament for the Inverness burghs in 1722, he was appointed Lord advocate in 1725 and lord president of the court of session in 1737. In the rebellion of 1745 he strove hard to keep the rebels in check, but his services were coldly received by the Government. He originated the idea of raising Highland regiments, later adopted by Pitt. He died Dec. 10, 1747. Culloden House was his property and in his family for generations.

Forbes, GEORGE WILLIAM (1869-1947). New Zealand statesman. He was born March 12, 1869, at Lyttelton, and educated at Christchurch. Entering parliament as member for Hurunui in 1908, he held office as minister of agriculture



Duncan Forbes,
Scottish lawyer
From an engraving



George W. Forbes,
New Zealand
statesman

and of finance before becoming premier in 1930. In the latter post he was also responsible for foreign and native affairs, scientific research, and railways, and from 1933 he was attorney-general. During his five-year premiership Forbes went to the Imperial Conference of 1930 and the World Economic Conference of 1932. His Coalition government was defeated by Labour at the polls, Nov. 27, 1935. He died May 18, 1947.

Forbes, (JOAN) ROSITA (b. 1893). British explorer and author. She crossed the Libyan desert in native costume in 1920-21, and reached Kufara, headquarters of the Mahomedan sect of the Senussi, not visited by Europeans since 1879. She made an expedition to Asir, 1922-23, and a journey across Abyssinia, 1924-25. A fellow of the Royal Geographical Society, she described her adventures in travel books and drew on her experience for novels mostly about the East. Her publications include *The Secret of the Sahara-Kufara*; *From Red Sea to Blue Nile*; *Forbidden Road—Kabul to Samarkand*, 1937; *The Prodigious Caribbean*, 1940. Her autobiography appeared in two parts: *Gypsy in the Sun*, 1944; *Appointment with Destiny*, 1946.

Forbes, DAME KATHERINE JANE TREFUSIS (b. 1899). British servicewoman, born March 21, 1899. A member of the Woman's Volunteer Reserve, 1916-18, she joined the Council of Emergency Service in 1935 and trained women to serve as officers preparatory to the formation of women's services. She was chief instructor at the A.T.S. school, 1938, and then attached to No. 20 R.A.F. coy., A.T.S. During 1939-43 she was director of the W.A.A.F., with the rank of air chief commandant, and was created D.B.E. in 1944.

Forbes, STANHOPE ALEXANDER (1857-1947). British painter. Born in Dublin, Nov. 18, 1857, he was educated at Dulwich College, and studied art at the R.A. schools, and with Bonnat in Paris. Influenced by the naturalistic methods of Bonnat, he settled at Newlyn, Cornwall, where he lived until his death, March 2, 1947. It was



Dame Katherine
Forbes,
British servicewoman

chiefly through Forbes that the Newlyn school (*q.v.*) obtained its distinctive character. Elected A.R.A. in 1892, and R.A. in 1910, he devoted his last years to studies of the neighbourhood.

Forbes-Robertson, SIR JOHN-STON (1853-1937). British actor, Born in London, Jan. 16, 1853,



Sir J. Forbes-Robertson, British actor

eldest son of John Forbes-Robertson, art critic and journalist, and educated at Charterhouse and Rouen, he studied art at the R.A. school, and elocution under Phelps. He made his stage début, March 5, 1874, at The Princess's, London, as Chastelard, in Mary Queen of Scots. In the same year he appeared with Ellen Terry at Astley's. Associated in turns with Charles Calvert, the Bancrofts, Irving, Wilson Barrett, and John Hare, he achieved his first notable success as Geoffrey Wynyard in Dan'l Druce, at The Haymarket, Sept. 11, 1876. His first venture as an actor-manager was at The Lyceum, Sept. 21, 1895, when he appeared as Romeo to the Juliet of Mrs. Patrick Campbell. His farewell season in London opened at Drury Lane Theatre, March 22, 1913, and closed on June 6. In that year he was knighted.

Gifted with a magnetic personality and exceptional elocutionary ability, he was one of the most popular actors of his time. His Hamlet, the Stranger in The Passing of the Third Floor Back, and Dick Heldar in The Light That Failed, were memorable. He toured several times in the U.S.A., and in Germany in 1898. His reminiscences, A Player Under Three Reigns, appeared in 1925. He died Nov. 6, 1937.

Sir Johnston's brother, as Norman Forbes (1859-1932), also won distinction as an actor. His sister, Frances, was the author of several novels. His wife, married in 1900, was May Gertrude (1874-1950); sister of Maxine Elliott (*q.v.*), of Oakland, Calif., who, as Gertrude Elliott, made her first appearance on the American stage in 1894, and later won favour as Peggy, in Mice and Men; Ophelia; Desdemona; Portia; Cleopatra, in Caesar and Cleopatra; Maisie, in The Light That Failed; Stasia, in The Passing of the Third Floor Back. Their daughter, Jean Forbes-

Robertson (born March 16, 1905), was outstanding as Peter Pan which she played in nine Christmas productions, and in Berkeley Square, Time and the Conways, and The Constant Nymph.

Force. Concept in physics derived from Newton's laws of motion. The first law ("Every body continues in a state of rest or of uniform motion in a straight line unless it is compelled by impressed forces to change that state") implies a qualitative definition of force. The second law ("Change of motion is proportional to the impressed force and takes place in the direction in which the force acts") indicates how it can be measured. The magnitude of a force, f , acting on a body is given by the product of a quantity, m , called the mass which is constant for any given body, and the rate of change in velocity, that is the acceleration, a , brought about. Thus $f = ma$.

The c.g.s. unit of force is the dyne, defined as the force which will give a mass of 1 gram an acceleration of 1 cm. per sec. per sec. Complete specification of a force requires a statement of the direction in which it is acting. Force, therefore, like velocity, is a vector (*q.v.*). The resultant of two forces is given by their vector product, or may be found graphically by the device called the Parallelogram of Forces (*q.v.*).

The original idea of force was derived from the feeling of muscular exertion. Newton, however, was already speaking of forces acting at a distance without any material connexion; appreciation of electrical and magnetic forces made the concept still more abstract.

Forced Loan. Money taken by kings and other rulers from their subjects by compulsion, but with the promise of repayment, which thus differentiates it from taxation proper. Something of this kind has been done almost as long as society has existed, but in England it first became prominent in the time of Charles I. In 1626 Charles resorted to the device of a forced loan. He dismissed Coke from the chief justiceship for denying its legality, and he punished those who refused to pay by billeting soldiers upon them and in other ways. The question was tested in the courts of law by the Five Knights' Case; in this the judges' decision implied that the king alone could decide whether or not a loan was illegal. To this the parliament replied by the Petition of Right, which declared the exaction of

"any gift, loan, benevolency, or tax without common consent by Act of Parliament to be illegal."

Force Majeure. English legal term. A force majeure clause is sometimes inserted in contracts to exempt the parties from liability for loss in certain circumstances. The expression is taken from the Code Napoléon. On the Continent the effect of such a clause is to exclude liability for loss due to circumstances independent of the will of man and not under his control. In England its meaning is not fixed but depends in each case on the nature and general terms of the contract. Alternative expressions, each with a slightly different meaning, are vis major, Act of God, inevitable accident.

Force Ouvrière, LA. See Confédération Générale du Travail.

Forceps. Instrument consisting of two blades for grasping or compressing tissues or objects. The midwifery forceps, used for assisting delivery in difficult labour, is one of the most beneficent instruments ever invented. There is some evidence that forceps of a kind were used in childbirth at Pompeii, and in the 10th century by Arabian physicians. The knowledge was, however, entirely lost, and was rediscovered about the beginning of the 17th century by Peter Chamberlen, a Huguenot refugee, who fled to England. Chamberlen and his sons and grandsons kept the secret in their family for nearly one hundred years, and it was not until 1733 that Chapman published a full description of the midwifery forceps. The word forceps meant an instrument for holding hot iron (Lat. *formus*, hot; *capere*, to grasp). A form of forceps is employed in nearly all surgical operations, and by dentists, watchmakers, etc. See Dentistry illus.

Forcible Entry. Term used in English law. By a statute of Richard II, it is forbidden for anyone claiming land to make a forcible entry on it. However good his title, he must not assert it by force, or he will be guilty of a breach of the peace, and be liable to a fine.

Forcible Feeding. Administration by force of food to a person who refuses to take it. Liquid nourishment is introduced into the stomach through a tube passed down the throat, or sometimes through the nostril. The procedure is often necessary with mental patients, or prisoners who refuse to eat. See Hunger Strike.

Forcing. Art of bringing flowers, fruit, and vegetables to a state of maturity at an earlier date than

in ordinary circumstances. Any heated greenhouse can be used as a forcing house, but where this is not available fresh stable manure may be spread at the bottom of a pit, about 3 ft. deep, and, when the rank steam has escaped, covered with a thick layer of good, rich loam, a cold frame or a series of portable hand-lights being placed over it. The decaying manure will create a high temperature, and the frames can be used for starting all half-hardy plants, and when the temperature of the decaying manure falls, the frames will serve to grow rhubarb, sea kale, and sometimes mushrooms. If the temperature falls too rapidly, it must be restored by the addition of fresh manure and litter.

Ford (Anglo-Saxon). Point in a river or lake at which man or beast can cross on foot. Fords and bridging facilities have fixed the site of all important riverine towns. Modern London includes the old city, built at the then best bridging point nearest the sea, and Westminster, founded where the Thames could be forded before London Bridge was built.

Ford, FORD MADOX (1873–1939). British author. Son of the music critic Francis Hueffer, and grandson of Ford Madox Brown (*q.v.*), he changed his surname in 1923. He published at 20 his first book of poems, *The Question of the Well*, under the pseudonym Feuil Haig. A prolific writer and brilliant critic, he was a distinguished personality in the society of his day. Among his best-remembered works are two novels written in collaboration with Joseph Conrad: *The Inheritors*, 1901, and *Romance*, 1903. Outstanding, too, was his sequence of four novels in which the characters were set against the background of the First Great War: *Some Do Not*, *No More Parades*, *A Man Could Stand Up*, and *The Last Post*. 1924–28. The founder and first editor of *The English Review*, he later wrote *No Enemy*, 1929; *When the Wicked Man*, 1932; *The Rash Act*, 1933. Besides a distinguished biography of Conrad, he wrote monographs on Rossetti and Henry James. He published reminiscences, *Return to Yesterday*, 1931; and *It Was the Nightingale*, 1934. He lived in France for many years, dying at Deauville, June 26, 1939.

Ford, HENRY (1863–1947). An American industrialist. He was born on a farm near Dearborn, Michigan, July 30, 1863, the son of an immigrant farmer from Cork.

He found work in an engineering shop in Detroit, and was also for a



Henry Ford,
U.S. industrialist

time a jeweller's assistant. Later he joined the Detroit Edison co. as an engineer, and experimented with a petrol-driven motor vehicle, completed 1892. After success with racing cars, Ford was able in 1903 to found at Dearborn his own company, destined to become the largest motor manufacturing concern in the world.

In 1914 he instituted a scheme of profit-sharing for his employees, and afterwards founded a trade school as part of his self-supporting organization. Something of Ford's independence of character at this time is shown in his much-quoted phrase, "History is bunk." Hoping to use his influence to end the First Great War by negotiation, he chartered a "peace ship" in 1915, and paid a vain visit to Scandinavia. When the U.S.A. went to war in 1917, Ford made munitions.

His policy of paying operatives at higher rates than were normal led to disagreement with the code put forward in 1933 by the U.S. National Recovery Administration. Although forced to make concessions to the code, he remained an opponent of the New Deal. He was president of the Ford motor co. until 1918, and again during 1943–45. He died April 8, 1947.

Ford's only son, Edsel Bryant (1893–1943), was president of the company 1918–43; a grandson, Henry (b. 1918) succeeded in 1945.



Ford. The American car-builder, Henry Ford, seated in his first model, completed in 1892

The car that made the Ford name and fortune was the Model T ("tin Lizzie"), of which 15,000,000 were produced between 1908 and 1928. It embodied the principles of simplicity in manufacture and operation, lightness of construction, and cheapness in initial and running costs. Farm tractors, called Fordsons, found a similar world market. After the First Great War, Ford established works in several countries, including that at Dagenham, Essex, claimed to be the largest in the world. Small 8-and 10-h.p. four-cylinder cars appeared, and in 1931 the V8 (eight-cylinder), a larger vehicle with an exceptional performance for its price. The company produced transport aircraft of its own design, and in the Second Great War operated the gigantic Willow Run plant, where 8,800 Liberator bombers were made. Aero-engines, including over 34,000 of the Rolls-Royce Merlin type, were also turned out by mass production. *Consult My Life and Work*, 1922; *Today and Tomorrow*, 1926, both H. Ford and S. Crowther; *Henry Ford*, J. G. de R. Hamilton, 1933.

Ford, JOHN (1586–c. 1639). English dramatist. Born at Ilsington, Devon, April 17, 1586, he spent a year at Exeter College, Oxford, and then entered the Middle Temple. His reputation rests on his tragedies *'Tis Pity She's a Whore*, 1626; *The Broken Heart*, 1629; and the historical drama, *Perkin Warbeck*, 1634. He collaborated with Dekker, Rowley, and Webster, with the two first in *The Witch of Edmonton*, c. 1621; with the last in *A Late Murder of the Son upon the Mother*. H. de Vocht's edition of his works appeared in 1932.

Ford Foundation. Trust fund established in 1936 by Edsel Ford (1893–1943). At his death, all his non-voting stock in the Ford motor co. passed to it; it received more of the same stock from Henry Ford's estate. In 1951, its resources were valued at \$500,000,000. It is managed by a board of seven trustees, and in pursuit of its primary object—to promote world peace—is prepared to devote funds to improving educational opportunities and economic well-being of people everywhere: e.g. India, in 1951 and 1952, received two grants totalling nearly \$3,000,000, to assist in training staff to help village development.

Fordwich. Parish and village of Kent, England. It is 2 m. N.E. of Canterbury, and was once a

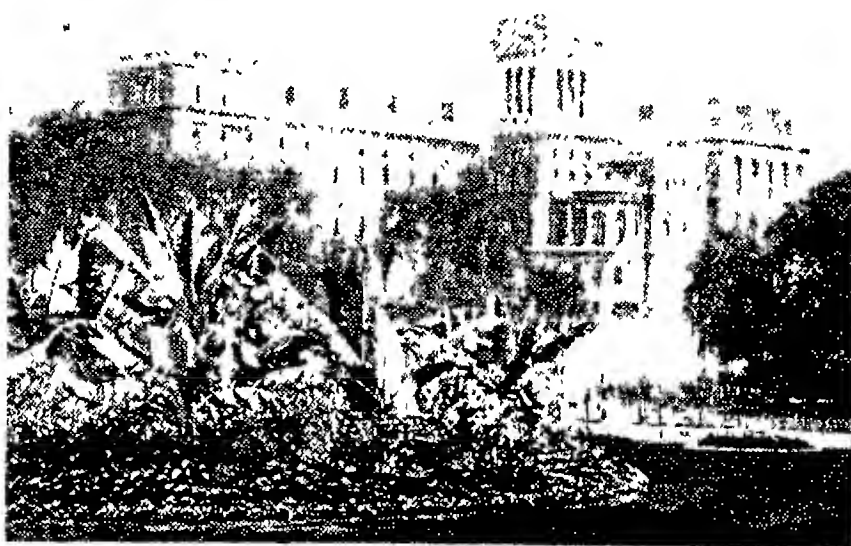
place of importance. In the Middle Ages and later, the Stour, which flows by here, was navigable, and Fordwich was a port serving Canterbury and a corporate member of the Cinque port of Sandwich. It has an old church, S. Mary's, with a Norman shrine. The old sessions house still stands, and there are remains of the port. It was a borough until 1884, when it lost its mayor and corporation under the Act of 1883.

Forecastle OR FO'C'SLE. Forward portion of a ship, usually providing living accommodation for the crew. In new steamers, however, particularly liners, the crew are housed in cabins farther amidships. The term forecastle is derived from the raised platform, fitted to the bows of medieval warships, from which the archers fired into enemy vessels. A monkey forecastle is a small deck below the level of the forecastle proper.

Foreclosure (old Fr. *forclos*, shut out). Term used in English law. When a mortgagor has failed to pay the debt in accordance with his covenant, the mortgagee may take possession of the land or other security; but the mortgagor has, at any time, the right to come and say, "Here is your money and interest, give me back my security." This right is called an equity of redemption. If the mortgagee desires to exclude the mortgagor from this equity, he must bring an action to foreclose, when the court orders that if the mortgagor does not redeem within a certain time, generally six months, the equity shall expire, and the mortgagee shall become the owner of the security. See Mortgage.

Foreign Jurisdiction Acts. Acts of 1890 and 1913 which give the British crown jurisdiction over British subjects in certain foreign countries to the exclusion of the courts of those countries. Jurisdiction usually arises from some treaty, but if a country is not subject to any regular government the Act confers jurisdiction. Of recent years, as the legal systems of even backward foreign countries have developed, this jurisdiction has decreased. See International Law.

Foreign Law. English law treats foreign law solely as a matter of fact. If an English court has before it a case that turns on a question of foreign law, it will not refuse to decide the dispute. For its satisfaction, therefore, qualified lawyers of the country in question must prove in evidence



Foreign Office, London, seen from St. James's Park

what the law is, and on that the case will be decided.

Foreign Legion (Fr. *Légion Étrangère*). French corps raised in 1831, to utilise the services of foreigners sympathetic to the French conquests in Algeria. It was formed at first in battalions like infantry of the line, but with varying numbers according to its strength. In 1884 the legion was divided into four battalions, to which a fifth was added in 1891. No Frenchman can serve in its ranks unless he renounces his nationality. The officer commanding is authorised to accept recruits of any nationality without inquiring as to their antecedents, and this has enabled many desperate characters and fugitives from justice to find refuge in the corps. Recruits must be between 18 and 40 and sign for a period of four years with the option of re-engaging.

In peace time the Foreign Legion used to garrison the French colonies in Indo-China and North Africa. It greatly distinguished itself in France in both Great Wars, serving with the Free French forces in 1944-45. Shortly before the Second Great War it was reorganized into two regiments of four infantry battalions, one cavalry regiment, a regiment of artillery, and a battalion of engineers. Attached to each regiment were disciplinary companies known as Zephyrs, in which offenders were drafted for service in the unhealthiest stations.

The Spanish government formerly maintained a foreign legion for service in Morocco.

Foreign Office. A British government department. Its head, the secretary of state for foreign affairs, has charge of all business affecting the relations of Great Britain with foreign powers. He formulates policy, appoints, sends out, and supervises ambassadors, consuls, and other diplomatic agents, and by various means, not excluding the

use of secret agents, keeps himself acquainted with the course of affairs abroad. The Foreign office is staffed by members of the foreign service which was created in 1943 by the unification of the former Foreign office and diplomatic, consular, and commercial diplomatic services, and was extended in 1946 to include overseas staff of the former ministry of Information.

Until Sir Edward Grey became foreign secretary in 1905 the position was almost invariably filled by a peer, among the holders being Lords Palmerston, Clarendon, Salisbury, Rosebery, and Lansdowne. Before 1782, when the foreign secretary first came into existence, the control of foreign affairs was divided between the two principal secretaries of state. The secretary is assisted by a parliamentary and a permanent under-secretary, and his office, entered from Downing Street, overlooks St. James's Park. A minister of state is sometimes appointed in periods of stress to assist the foreign secretary.

Foreign Service. A British government service concerned with international affairs, political, social, and economic. In 1943, the Foreign office and the former diplomatic, commercial diplomatic, and consular services were amalgamated into a distinct service of the crown entirely separate from the home civil service. Recruitment is by competitive entrance examination; a period abroad at the expense of the state follows. The examination is conducted by the Civil Service Commissioners. A proportion of the annual vacancies may be allotted to entrants nominated by a selection board. In 1946 women were admitted on equal terms with men, but their number was limited to 10 p.c. of the total entrants.

Forel, AUGUSTE (1848-1931). Swiss psychiatrist and myrmecologist. Born Sept. 1, 1848,



Auguste Forel,
Swiss psychiatrist

he was trained as a physician, studied psychotherapy, and in 1879 became director of a mental hospital near Zürich, where he remained nearly 20 years establishing

an international reputation as a neurologist, and one of the most eminent alienists of his day. He was also an early supporter of eugenics. His best-known work was *La Question Sexuelle*, 1905, translated into many languages, including English, evolving a new theory of the connexion between nerve fibres and brain cells. After leaving Zürich he devoted himself to a personal crusade, travelling all over Europe to make war against drink and sexual immorality and in support of internationalism and education. At the age of 68, partially crippled by paralysis, he became an active socialist.

From his schooldays his life-long hobby was the study of ants, and his eminence as a myrmecologist was even more widely based than his reputation as a psychiatrist. His collection of ants comprised over 6,000 species, races, and varieties. Forel died July 27, 1931; his autobiography was published posthumously (Eng. trans. B. Miall, 1937).

His brother François Alphonse (1841-1912) became famous for his geographical and geological studies and as a seismologist. Professor at Lausanne, 1869-95, he wrote *Le Lac Léman*, 1886. He died Aug. 8, 1912.

Foreland, NORTH AND SOUTH. Two chalk headlands on the coast of Kent, England. The North Foreland, about 2½ m. S.E. of Margate, is the Cantium of Ptolemy, and has a lighthouse 188 ft. above sea level, with a light visible at 20 m. The South Foreland, 3 m. N.E. of Dover, has two light-



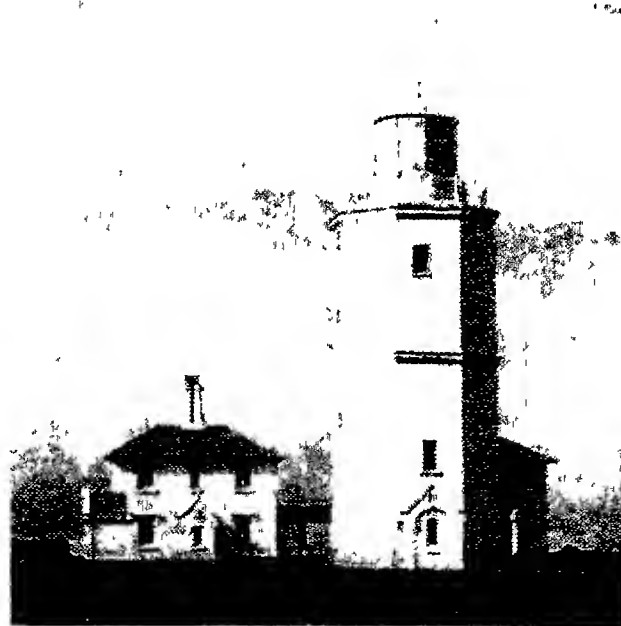
houses respectively 375 ft. and 275 ft. above sea level, and visible at 26 m. and 23 m.

Foreshore. Part of a beach or seashore which lies between the extreme limits of high and low water marks, i.e. is covered at high tide and uncovered at low tide. The extent of the foreshore depends partly upon the slope of the ground and partly upon the height

of the tides. The boundary has been fixed, by English law, as the mean between the high and the low water mark. Foreshore is vested in the crown. See Coast.

Forest. Term originally applied to a royal demesne set apart for the preservation of beasts of the chase and to afford the sovereign facilities for hunting. Not necessarily wooded or uncultivated, it was frequently called forest only because forest law was applied to it. It consisted of vert and venison. The former comprised the high wood, underwood, and turf; the latter the beasts of the forest, chase, and warren. In Scotland the term deer-forest is still used to describe an extensive region quite devoid of timber. In general, however, the word forest (late Lat. *foresta*, ultimately derived from Lat. *foris*, out-of-doors) now means a large tract of uncultivated land thickly wooded.

Forests are of two kinds—temperate and tropical; and the temperate are subdivided into deciduous forests of oak, elm, maple, beech, birch, and other temperate hardwood trees whose leaves fall every autumn, and coniferous forests of fir, pine, larch, and other evergreens which



Foreland. The North Foreland lighthouse S.E. of Margate and, on left, the chief South Foreland lighthouse, both well-known landmarks on the coast of Kent

produce softwood and pulpwood. Down to historical times, much of central and northern Europe was covered with forest, and even in Great Britain there are today stretches of woodland (e.g. the New Forest) which are remnants of the forests that once clothed the island. Over those parts of Europe most suitable for agriculture and industry, the forests have been gradually cleared. Only Scandinavia, N. Russia, and Finland have extensive forests today.

Much of the forest that existed in N. America until the mid-

19th century has also been cleared though vast stretches remain. Some 450 million acres of the U.S.A.—close on a quarter of its whole area—are still forested. Oregon is now the most productive state. Fire is a serious menace—millions of acres are burnt annually. Canada has more than 750 million acres, of which about 490 million acres are accessible and productive; British Columbia produces more than half Canada's total of pulpwood. Production, that is to say, in N. America, has shifted to the Pacific side of the continent, the best of the areas in the E. having been stripped.

The chief timber exporting country of Europe is Sweden, with 57 million acres of forest. Germany has over 30 million acres; much of it has long been under state control and worked on a scientific system. The making of clocks, brooms, musical instruments as well as the production of timber was encouraged by successive governments. Finland, with 62 million acres of forest, produces timber, wood-pulp, and paper. More than 40 p.c. of the U.S.S.R. is forested; she and Canada possess the world's chief reserves of softwood. All the Russian forests are under government control, but the peasants have the use free of some 73 million acres. The exploitation of the Russian forests, however, presents great difficulty, since timber can be handled satisfactorily only where it can be floated down a river to a port or a manufacturing town, and rivers of Siberia and N. European Russia, where the greater part of the Russian forests lies, flow into the frozen Arctic Sea, and are themselves frozen for a large part of the year.

Oak, the principal temperate hardwood, does not grow S. of the equator; it grows chiefly in the forests of Central Europe, Canada, the U.S.A., and Japan. Great Britain's unique "brown oak" is much in demand for furniture and panelling.

From the forests of the tropics come the most beautiful and valuable cabinet woods. Mexico, Honduras, and other parts of tropical America are the home of mahogany, W. Africa of the so-called African mahogany, India of ebony, Central America and the W. Indies of rosewood and cedarwood. Burma, Siam, India, and Java produce teak, W. Australia the redwood of the eucalyptus tree. But the forests of the tropics

are far more mixed than those of the temperate zones, and are choked with a dense undergrowth and a wealth of climbing plants, so that it is difficult to extract the particular tree required.

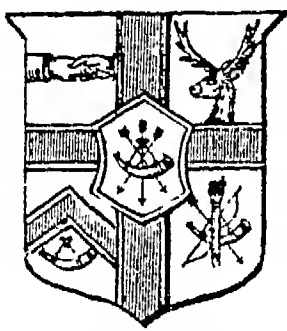
The increased demand for timber and wood pulp leads to the decrease of temperate forests much faster than nature unaided can replace them, and governments in both N. America and Europe take steps to conserve their remaining forest, and to replant as trees are cut down. The clearance of large tracts of land formerly under forest has had an adverse effect in parts of N. America, reducing rainfall (large masses of trees cool winds passing over them, with consequent precipitation) and leading to soil erosion by the resulting dry winds. See Forestry.

Forest Bed. Series of deposits formed above the Pliocene Weybourne Crag and occurring beneath the glacial boulder-clay cliffs on the Norfolk coast. It comprises a lower fresh-water bed of clayey silt, an estuarine forest-bed (20 ft.) above, with stumps of trees and bones of mammals, and an upper bed of sand and blue clay (2-7 ft.), containing fresh-water shells. See Pliocene.

Forest Cantons. Four cantons of Switzerland, enclosing the Lake of Lucerne (Ger. Vierwaldstätter See). They are Unterwalden, Uri, Schwyz, and Lucerne.

Forester, CECIL SCOTT (b. 1899). British author. Born Aug. 27, 1899, he went to Dulwich College. He began as a writer of biographies. A psychological thriller, *Payment Deferred*, was made into a play, and an early naval story, *Brown on Resolution*, into a film. Other successful novels were *The General*, and *The Gun*. In *The Happy Return*, 1937, appeared Horatio Hornblower, a sea captain in the Napoleonic Wars, who was to go through several books and become a commodore and a peer; one Hornblower story, *A Ship of the Line*, won the James Tait Black prize in 1938. *The Ship*, 1943, was a study of the personnel of a cruiser in the Second Great War, based on Forester's journeys in H.M.S. *Penelope*. His post-war publications included *Lord Hornblower*, 1946; *The Sky and the Forest*, 1948, considered outstanding; *Mr. Midshipman Hornblower*, 1950; *The Good Shepherd*, 1955.

Foresters, ANCIENT ORDER OF. British friendly society. Founded in 1834 to provide its members and their dependants with weekly allowances during sickness, old age,



Foresters' arms

or widowhood, it is one of the largest societies in the country. It retains much of the traditional ritual associated with membership, but this is not compulsory upon members. It is organized in autonomous courts and districts which owe a certain allegiance to the central body, and the government is vested in the high court of the order which meets annually in different cities. Contributions vary according to the benefits desired. The order has spread to America and the British dominions. See Friendly Societies.

Forest Gate. District of Essex, England, and an E. suburb of London, within E. and W. Ham. It is 5½ m. by railway N.E. of Liverpool Street station. There are chemical and other industries. Pop. (1951) 13,988.

Forest Hill. Residential district in the London metropolitan borough of Lewisham. It is 5½ m. by electric railway S.E. of London Bridge station. The Horniman Museum, standing in a public park, and built at a cost of £40,000, was opened to the public in 1901. The district was heavily damaged by German bombs in 1940 and flying bombs in 1944. Pop. (1951) 16,097.

Forest Marble. Name of a geological formation comprising

shelly and flaggy limestones. Alternating with layers of clay or marl, it is one of the Great Oolite group of Jurassic stratified rocks, and occurs in Dorset, Somerset (135 ft. in thickness), Wiltshire, through Oxfordshire into Buckinghamshire, where limestone thins out and is thence represented by clays. The formation is named after Wychwood Forest, Oxfordshire, where it was formerly quarried for building stone.

Forest Reserves. Name given in the U.S.A. to areas set aside for the conservation of trees and now known as national forests. Under legislation begun in 1891 and steadily expanded some 178 million acres in 158 forests, including Alaska and Puerto Rico, are administered by the U.S. forest service. Individual states administer 20 million additional acres and local communities a further 2,500,000 acres.

Canada also has forest reserves, about 143,000 sq. m. having been set apart—32,000 in Quebec, 30,000 in British Columbia, 19,000 in Ontario, 14,000 in Alberta.

Forest Row. Parish and village of Sussex, England. It is 3 m. S.E. of East Grinstead, and a convenient starting-point for a visit to Ashdown Forest. Between Forest Row and East Grinstead are the ruins of Brambletye House, home of the Lewknor family, and theme of a romance by Horatio Smith. Pop. (1951) par., 3,258.

FORESTRY AND AFFORESTATION

H. G. Champion. C.I.E., Prof. of Forestry, Oxford University

An explanation of what forestry is, and how and why it is carried out, in temperate woods and forests, with particular reference to the growth of trees for timber. See also Forest; Timber; and entries dealing with particular trees, e.g. Beech; Larch; Oak

Forestry is the general management of woods and forests, including the creation of woods on bare or scrub covered land. It is an applied science like agriculture, dealing with trees as a crop rather than individually; and also, in the main, with natural tree growth rather than with plantations. It has to do essentially with the growing of trees, though it may extend to the felling and extraction of timber and other natural tree products from the forest, together with the necessary processing.

The value of timber greatly exceeds that of all the other forest products, such as resin, cork, tanbark and charcoal.

The forester must have a fair acquaintance with all branches of forestry. First comes the care of existing woods and the raising of

young crops and plantations, termed silviculture. This involves knowledge of everything affecting the growth of trees as crops and is primarily a biological science based on botany, understanding of soils, and climatology; it includes appreciation of the object, methods, and results of human interference with the natural processes of forest life.

In Great Britain, where self-sown seed from older trees rarely gives sufficient and sufficiently rapid young growth to replace the parent crop, it is usual to plant out small trees raised in forest nurseries. In some types of forest, however, natural regeneration is left to itself, artificial regeneration (including sowing of seed) being used only to supplement the natural process, and in afforestation



1. An outward symptom of internal disease: red-rot fungus, *Fomes annosus*, on Scots pine. 2. Sulphur-tuft fungus, *Polyporus sulphureus*, on oak. 3. Larva of sawfly, *Lophyrus pini*, attacking young pine shoots. 4. Yew forest on Surrey chalk hills. 5. Wood of Scots pine grow-

ing in Surrey. 6. Horntail wasp, *Sirex gigas*, whose grub spends several years mining the solid wood. 7. Self-sown pine wood on a Surrey heath. 8. A Surrey beech wood. 9. Neglected oak trees, *Quercus robur*, with much wood but yielding little serviceable timber

FORESTRY: BRITISH FOREST TREES AND SOME PESTS WHICH THREATEN THEIR GROWTH

(i.e. creation of new forests, or their re-creation where natural growth has been destroyed).

In the nursery, healthy, vigorous stock of a size found by experience to be most suitable for the planting operation contemplated is raised as quickly and cheaply as possible. Sometimes the seedlings are put out directly into the forest from the seed bed, usually after two seasons' growth; more often they are first lined out in another part of the nursery at some such spacing as 3 ins. by 9 ins. and left to grow another season or two before they are planted out; they develop a more suitable root system as a result of the move. Trees are planted out at various spacings related mainly to the anticipated rate of growth. A slow-growing hardwood like oak may be planted as close as 3 ft. by 2 ft., i.e. over 7,000 plants per acre, whilst a quick-growing softwood such as larch or Douglas fir may be planted at intervals of 5 ft. by 5 ft. (1,742 plants per acre), or even more.

Preparing Ground for Planting

Before planting, some preparatory work on the site is usually necessary, for example, clearing undergrowth or weeds, or working up the soil. If there is a thick layer of vegetable matter, ploughing or some other work will have to be done on the planting site so that the roots can penetrate readily into the underlying mineral soil. Draining may also be necessary. Planting can be done in various ways, the object being to get the roots firmly into the soil in as natural a position as possible without undue labour or expense. In some countries seed is sown in patches or lines. The kind of tree to be sown or planted on any given site, or the mixture to be used, has to be carefully selected, taking into account all the factors of soil and situation.

Young trees need protecting from competing weeds, and weeding and cleaning must be continued—for several years in the case of slow-growing trees such as oak—until the branches of the young trees overlap, and weeds no longer menace them. At this thicket stage it is almost impossible to force a way among them, but after some years the lower branches of the young trees die off for want of light, and it is then usual to "brash" or "brush up," by trimming off all the dead lower branches from the ground level up to six or seven feet. At this time, or a little later, trees whose stems

are ahead of the rest of the crop and badly shaped or coarsely branched (known as wolves) are removed, to allow of enhanced growth by adjoining better stems. Then over a long period the tree crop is periodically opened out by thinning, i.e. by removing the less satisfactory stems to give the remainder room for further development. If thinning is too heavy the branches will develop too strongly and the timber become knotty, whilst at the same time the total wood growth on the area is likely to be less than it could be; if it is too light the stems become drawn up and weak.

After a period varying with the kind of tree, rate of growth in height falls off and the aim of further thinning is to maintain good healthy crowns, and thus promote continued steady growth in stem-diameter. One problem of forestry is to find markets for the small timber removed in thinnings.

The age at which wood becomes mature and ready for felling and regeneration, called the rotation age, varies with the kind of tree, and the size of it most in demand. Where timber for sawing is grown the rotation is rarely less than about 60 years for the quick-growing softwoods like larch and spruce, and may be 150–200 years for oak; Scots pine and beech fall between these limits.

Coppicing the Wood

Tree crops of maturing or mature age are more open than young woods, and it is possible to have an underwood of smaller stems, especially with hardwoods. This may be planted or semi-natural, of hazel or various deciduous trees such as ash, sycamore, oak, or chestnut, and it is usually cut down (or coppiced) at intervals of 7 to 15 or more years, to yield poles and sticks. Sometimes the whole wood is coppiced, a new crop growing up from shoots from the stumps; this method was prevalent when wood for fuel was needed, and was particularly applied to oak when the bark for tanning was in good demand. Repeated coppicing leads to gradual deterioration of the crop as the stocks get old; where management is efficient, worn-out stocks are regularly replaced. Conifers cannot be managed by coppicing as they do not produce shoots when cut. They are, however, often underplanted (as is the shade bearing beech) below open crops of hardwoods or larch, to keep the ground covered and make fuller use of the land. When the over-

wood is due to be felled the underplanted crop should give a yield of small timber at the same time; hemlock and Western cedar (*Thuja*) are particularly suitable for use in this way.

A combination of coppice with larger trees (coppice with standards) is common. This may originate by the retention of a few picked stems evenly distributed over the area when a young crop is first coppiced. At each subsequent coppicing a few of these standards may be felled to provide larger timber, and a new lot of maiden standards be retained from seedling trees that have come up among the coppice, or by planting, or from the best coppice shoots still standing on a healthy vigorous stock. In time, the crop contains an open sprinkling of standards of several ages and sizes above the coppice growth. The standards are nearly always trees such as oak and ash which do not cast too dense a shade. This form of crop supplies continuously a wide range of material well suited to meet the varied requirements of an agricultural estate.

Adequate Space Important

When trees of all ages and sizes occur singly or in small groups throughout the wood, fellings should be made on a cycle, returning to each part of the wood every few years and taking out a selection of trees of all sizes, including some mature, full sized trees, but otherwise removing inferior trees and allowing adequate growing space for all that are kept. To retain the all-aged structure continuous regeneration must be ensured. Such selection forests are coming more and more into favour on the Continent; they call for highly skilled management.

Forests are subject to injury and disease of many kinds. There are risks from natural physical phenomena such as wind, frost, snow, and drought, varying with locality and from year to year. Exposure to strong winds, particularly if they are laden with salt spray, has a general stunting effect on tree growth, whilst storms may uproot or break trees on an extensive scale. A tree that has grown up exposed to wind is always more firmly rooted than one which has grown up sheltered by its neighbours. It is accordingly a guiding principle when arranging the sequence of fellings that trees should never be suddenly exposed to the wind by the felling of others to windward of them; this in turn means so arranging

that the older crops in which there will be heavy timber felling are towards the leeward side of the forest, with the fellings annually moving up the prevailing wind. Trees, *e.g.* spruce, which do not root so deeply, as, *e.g.*, oak and pine, and so are more likely to be blown down, must not be planted on exposed sites or left standing alone in felling.

Damage by Frost and Snow

Snow also may uproot or break trees, and its weight often bends over young crops beyond recovery, particularly if they have been inadequately thinned. Frost damage is a serious risk in many places. Some species are particularly susceptible, *e.g.* ash, and should not be planted on sites known or likely to be frosty. Late frosts which kill the newly developed shoots and foliage can be very injurious, not only seriously checking growth but also causing forking of the stem or bad curvature where a side shoot takes the lead in place of a frosted leader. Considerable protection against frost damage is afforded to young growth by an overwood. Sometimes a hardy, quick-growing species is mixed with a slower, susceptible one as a nurse crop, to be removed when the danger is over.

Many forest trees are liable to insect damage, especially when growing in pure crops. Thus, it is commonly inadvisable to replant at once an area where a pine crop has been felled, owing to the great probability that the pine weevil, which breeds in the stumps, will attack the young plants and kill a large proportion of them; after about three years the food material in the stumps is exhausted and the weevils can no longer survive. Another very injurious insect burrows in the shoots of young pines and causes serious malformation. Defoliation by caterpillars is common, being particularly conspicuous on oak; it is difficult to prevent, and causes much loss of growth. Insect-eating birds should be encouraged as the most practicable method of minimising insect attacks.

The forester also has to contend against fungus diseases. Some, for example the honey fungus, kill young plantation trees outright; others cause cankerous growths deforming the tree and reducing its value for timber, the larch canker being a common example; yet others cause decay in the heartwood and render the timber worthless. Trees planted on unsuitable sites are prone to fungus

diseases, and some stocks are more susceptible than others. Rodents are the most serious enemy of British forests; in many parts of the country it is impossible to raise a plantation without protection from rabbits. Grey squirrels are destructive of beech, ash, and sycamore. Small rodents and birds, particularly the wood pigeon, are largely responsible for the failure of natural regeneration of oak and beech in England.

Protection against fire is very important, especially in conifer plantations. The forest is divided into blocks of moderate size separated by fire lines kept clear of inflammable material (often by ploughing), look-out towers are kept manned, and organization makes it possible to get men and extinguishing appliances quickly to an outbreak.

An important branch of forestry deals with the measurement of trees and crops, their rate of growth, and their valuation. The work of felling trees and extracting them from the forest with minimum damage and wastage is dealt with by the forest engineer, who often also carries out preliminary saw-milling on the spot.

Effect on Soil and Water Supply

Production of timber is often only one of the objects, and not necessarily the most important, of afforestation. Forests exert a considerable effect on the soil and water supply; they moderate temperature and give protection from wind. They also drain swampy land, rendering it more healthy, provide sporting and recreational facilities, and preserve wild life. Taking all the matters applicable to local conditions into consideration, the forester usually draws up a working plan, laying down all operations to be done each year for a period of years (usually 10) in each subdivision of the area, felling and planting, road work, drainage, maintenance operations, and improvements. Where scientific forestry is practised, the fellings and the composition and structure of the crop are usually regulated to give as nearly as possible the maximum yield in perpetuity, though in some cases, *e.g.* in state-owned forests, other considerations than maximum sustained production or maximum financial return may be given weight; thus, less paying kinds of trees may be grown for reasons of amenity.

Great Britain has an exceptionally low proportion of its land area

under forest, only $5\frac{1}{2}$ p.c. or three million acres, and most of this forest produces far less timber than it might owing to low stocking and poor management. Less than 5 p.c. of British requirements of timber are home grown. There was no state organization or policy until the Forestry Commission (*v.i.*) was set up in 1919. Improvement of management in privately owned woodland is particularly needed in the hardwood forests of oak, ash, and beech totalling about one million acres.

The climate of Britain is very well suited to the growth of coniferous timber, particularly in the W. parts, where good results have been obtained with some of the trees of the W. American forests, such as Sitka spruce and Douglas fir; whilst pine grows excellently on poor, sandy soil in the S. and E. which is of low agricultural value. On good sites the average rate of growth reaches about 170 cu. ft. per acre per annum for Douglas fir, 90 cu. ft. for Scots pine, 70 cu. ft. or less for oak.

Forestry Commission. Body formed in 1919 to promote the interests of forestry and develop afforestation in Great Britain. Developed from the Forestry sub-committee of the Reconstruction committee formed in 1918, it was set up as a result of the serious reduction in standing timber in Great Britain during the First Great War. It is a body corporate appointed every five years under the Forestry Acts of 1919-45, and consists of a chairman, nine commissioners (of whom all but one are unpaid), and four directors, one each for England, Scotland, and Wales, and one in charge of research. The aim of the commission is to replenish the supply of native timber by maintaining existing forests and by encouraging afforestation. The crown woods were transferred to it in 1924; by 1957 it owned 2,102,300 acres, of which 1,005,200 acres were planted. It also advises and makes grants or loans to local authorities and private landowners for the purpose of afforestation, and has power to take over the management of woodlands which it considers to be unsatisfactorily managed.

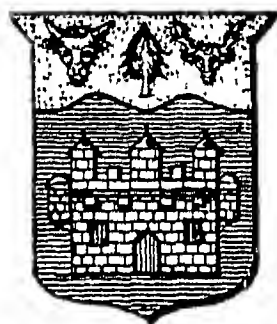
Expenses are met from a forestry fund, derived partly from a Treasury vote and partly from profits on the sale of timber and lands; expenditure during the financial year 1955-56 was £8,351,000. The Forestry Act of 1945 placed the commission under the control of the minister of

Agriculture and the secretary of state for Scotland (but not of their departments); transferred power to acquire land from the commission to the Agricultural commissioners; and allocated to the commission £20,000,000 to enable it to carry out afforestation involving the employment of 13,000 men and the planting (or replanting) of 365,000 acres, as the first part of a five-year plan.

Forestry Corps. Unit of the British army during the First Great War. To secure an adequate supply of timber for war purposes lumber units were formed in Canada, the first draft reaching England in April, 1916. The corps was formed from these battalions in Oct. and eventually numbered 18,000. In the Second Great War a forestry unit from Newfoundland was working in Great Britain in Nov., 1939. There was no distinct forestry corps but the work was performed by battalions or companies of specialists from Canada, Bermuda, Honduras, the Pioneer Corps, and Royal Engineers. There was also a forestry section of the Women's Land Army.

Forez, MONTs DU. Wooded range of mts. in the dept of Loire, France. They lie in the W. of the dept., and divide the basins of the Allier and the Loire. The loftiest summit is Pierre-sur-Haute, 5,380 ft. The range is also known as the Monts de la Madeleine and the Bois Noirs.

Forfar. Royal burgh, and the county town, of Angus, Scotland. It stands in the vale of Strathmore, 14 m. N. of Dundee, on main rly. and road routes from Perth to Aberdeen. The burgh's chief edifices are the county buildings, town hall, court house, and Meffan Institute.



Forfar arms

A public hall and a park were given by Peter Reid, a merchant here. The chief industries are the manufacture of linen and jute; others are bleaching and rope-making. The burgh is governed by a provost and council.

Forfar was a royal residence of Malcolm Canmore, whose castle on a hill of the N. of the town was taken and destroyed by Bruce in 1308; its site is marked by a cross erected in 1648. It was made a burgh in the 13th century. Under the 1948 redistribution, the burgh of Forfar is part of the

county constituency of South Angus. Market days, Mon. and Fri. Pop. (1951) 9,981.

Forfarshire. This Scottish county has been officially known since 1928 as Angus (*q.v.*).

Forfeiture (late Lat. *foris factum*, something done outside). Deprivation of lands, goods, or other property, usually in consequence of a sentence passed by a court of law, or some breach of the law. In English law a person convicted of felony, treason, *felo de se*, and certain other offences, including striking a judge, forfeited all his lands and goods to the crown. This was abolished by the Forfeiture Act, 1870. At common law, also, an illegal conveyance of land, *e.g.* to an alien, before the Naturalisation Act, 1870, or to a corporation in mortmain, was similarly punished.

Leases frequently provide that the landlord may re-enter the premises and forfeit the lease if the tenant fails to carry out his obligations—*e.g.* to pay the rent or keep the premises in repair. The court will usually prevent the landlord from enforcing forfeiture if the tenant makes good his default. In the case of failure to pay rent the tenant may apply to the court for relief within six months of the landlord obtaining judgement. For breaches of other covenants, except where forfeiture is on the ground that the tenant has become bankrupt or his interest has been taken in execution, the landlord cannot

forfeit unless he has served a notice. By the Leasehold Property (Repairs) Act, 1938, which applies to the leases for 21 years or more of a house of rateable value of £100 or less, if the landlord more than 5 years from the end of the lease and with a view to the forfeiture of the lease serves a notice on the tenant to carry out repairs, the tenant may serve a counter notice, then no proceedings can be taken without leave of the court.

Forge (Lat. *fabrica*, workshop). In metallurgy, term with a wide meaning. It covers the simple hearth of the blacksmith, early furnaces such as the Catalan forge (*q.v.*), in which malleable iron was produced in Europe for a long period, and the modern extensive plant comprising furnaces, cranes,

hammers, rolling mills, presses, engines, or motors and boilers, which make up an iron-manufacturing works. It always relates, however, to the working of metals from a crude or semi-manufactured form, to a higher order, as distinguished from melting and casting. See Iron; Steel.

Forgery (Lat. *fabricari*, to frame). English law term for making or altering a written instrument which purports to be valid with intent to defraud (or in some cases to deceive). The notion that forgery always consists in signing a false name, or imitating somebody's signature, is wrong. Thus, to alter the date or amount on a cheque, account, or receipt, though the signature is genuine, is forgery, if the alteration be made with intent to defraud. Merely to subscribe a false name on a note or cheque may not be forgery if there is no fraudulent intent. The law on the subject is the Forgery Act, 1913. See False Antiquities; Literary Forgery.

Forget-Me-Not. Hardy perennial plant of the family Boraginaceae, genus *Myosotis*. Natives of Great Britain, their height is from 7 ins. to 18 ins.; the flowers are blue and yellow. Several cultivated varieties are raised from seed planted out of doors in spring, and transplanted to their permanent positions in the autumn when they will flower in the spring and summer of the following and successive years. The best position is a moist



Forget-Me-Not. Leaves and flowers of the perennial plant

corner of the rock garden. The well-known blue variety is *M. palustris* which, though found naturally by the sides of streams, will thrive equally well in the garden as an edging, or in small beds or borders in moist peaty soil. A rarer natural species is *M. palustris alba*, which has white flowers.

Forging. Production of articles of iron or steel or other metal by hammering, pressing, rolling, or otherwise shaping the metal while heated but not in a molten condition. It is distinguished from casting by the fact that the metal is never raised to a temperature sufficiently high to melt it.

It is almost certainly the most ancient branch of the whole art of metallurgy, and was first practised by primitive man in shaping

pieces of native copper into rough weapons or implements. It depends upon the property which metals possess, some more eminently than others, according to which they "flow" under pressure while in the solid state. In its broad sense it embraces all the operations of shingling, cogging, and rolling by which "merchant" bars and plates are produced; the works in which such operations are carried out, while frequently styled rolling mills today, were originally termed forges, and the term is still largely retained.

These processes involve, first, the proper heating of the crude mass of metal to the requisite temperature; and, secondly, the use of tools specially adapted to impart the desired shape to the heated mass of metal. They are modified more or less according to the metal which is to be operated upon—iron, steel, copper, magnesium, aluminium, gold, silver, or alloys of these. The forging proper will nearly always begin with a reducing operation, "drawing down" a piece of metal to a smaller size.

Thus, in the production of an ordinary stonecutter's chisel, a round or a six-sided bar of steel of the desired thickness will be taken. The end of this bar will be heated in the smith's fire, and as soon as the right temperature has been reached the bar will be withdrawn, the heated end laid on the smith's anvil and hammered out—drawn down—until it has assumed the required chisel shape. If the chisel is a small one the whole operation so far may be done by the smith himself with his hand hammer.

Principal Operations of Forging

Otherwise the chisel will be finished by the use of a "swage," which in this case will be a flat-faced tool held in a handle made of twisted iron rod. The smith will lay the face of this swage on the end of the chisel and his helper or striker will strike it with his sledge-hammer, thus producing a finished surface of the desired shape, free from hammer marks. The end of the bar will then be notched by means of a smith's chisel at a distance up the bar corresponding to the length of the chisel desired, and the piece broken off. It is not yet finished, however; it will be desired to flatten out and round off the blunt end of the chisel. That end is therefore heated again, the chisel is then withdrawn, and the end hammered or knocked upon the anvil, when it will be broadened out more or less, as required. This operation is called "upsetting." The production of this simple article

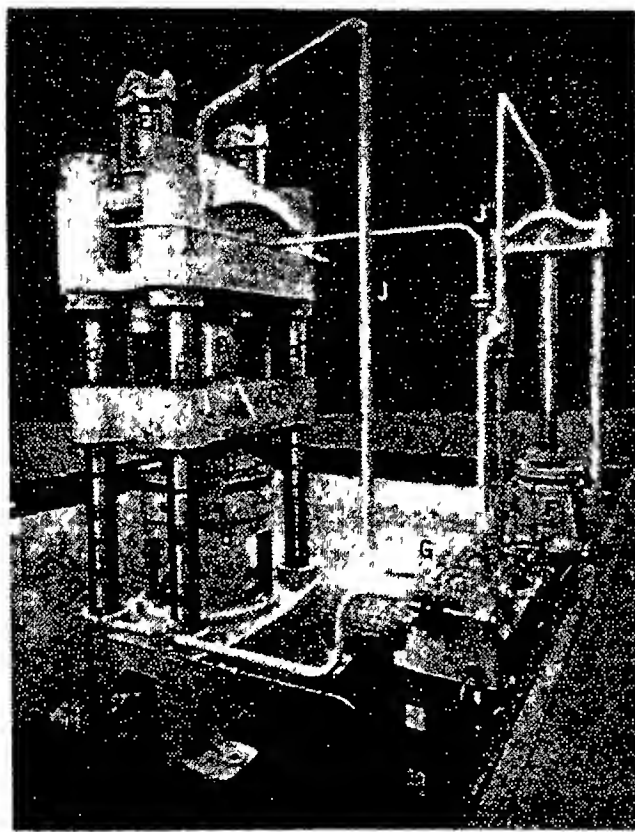
thus illustrates four principal operations of forging—heating, drawing down, cutting off, and upsetting.

Other principal operations are bending, holing, and welding. In the production of a great propeller or engine shaft which may weigh 100 tons, or of a 100-ton gun, the operations are essentially the same.

Drop or Die Forging

In the modern system of drop or die forging, the heated piece of metal is pressed into a die, a hardened steel form, by a hammer falling or dropping repeatedly upon the die. The hammer is worked mechanically, its weight amounting in large machines to 3,000 lb. Many of the parts of motor-cars, motor-cycles, bicycles, and other articles in iron, steel, and non-ferrous metals are made by drop forging. Bolts and nuts, screw blanks and rivets are now made chiefly by machine forging, in which the machine takes a heated bar of iron or steel, cuts off a definite length, shapes the latter to the form required, and ejects it automatically. See Casting; Metallurgy; Welding.

Forging Press. Instrument used in metallurgy. The increasing sizes and complexity of articles in malleable iron and steel required in



Forging Press. A, A'. Base and head connected by columns, a, a', a''. B. Stand attached to base and to upper part of which tables and dies are attached. C. Inverted platen attached to ram, D, which works up and down under hydraulic pressure. Platen slides up and down columns. E, E'. Retractor rams which pull up the platen after each downward stroke. F. Intensifier which puts final extra pressure on ram, D, and articles being made. G. Hydraulic pumps working rams. H. Flanged tire of small railway truck wheel receiving finishing press. Ram, D, may make from 30 to 80 strokes per minute, each pressing article a little nearer final shape. J, J', J''. Hydraulic connexions conveying pressure to the various rams

engineering particularly, such as heavy flanged plates, cranks, and crank shafts, began to make their production by means of the steam-hammer difficult. Attention was therefore directed to the hydraulic press as likely to prove a more effective appliance, and such objects are now largely produced by its aid. Very powerful presses, capable of exerting a total pressure of 10,000 tons, have been built for forging purposes. The illustration shows a press of this character with its pumps and control valves, adapted as it stands for the production of flanged wheels and other heavy flanged plates by direct pressure.

Forisfiliation (Lat. *foris*, outside; *familia*, family). In Scots law, the alienation of a child from his father and exclusion from further inheritance, by marriage, by provision made for him by his parents in ante-nuptial settlement or other portioning, or by his own renunciation of his legal right to legitim (*q.v.*). The custom is derived from the Roman law of emancipation of a son from his father's power by fictitious sale and manumission, by imperial rescript, or by formal declaration, after which the son became independent (*sui juris*), quitted the family to which he formerly belonged, and, as a general rule, lost the rights of agnation.

Fork (Lat. *furca*). Instrument for holding or lifting. It consists of a handle, terminating in two or more prongs. An example is the table-fork of silver or other metal. A tuning fork (*q.v.*) is a two-pronged steel instrument which when struck gives a fixed and definite note, used to determine musical pitch. By analogy the word is used for something (*e.g.* a road) which divides into two.

The farm implement of this name has a wooden handle and two or more steel tines. The two-tined kind, when large, is known as a pitchfork, used for loading hay or grain. Short, stout, emptying forks, of similar pattern, serve for unloading, while turning and collecting forks are still smaller, but with the same number of tines. Digging forks possess three to five tines, which may be round, square, or flat. Additional leverage is given by a sharply bent neck, and a short handle is preferred. Dung forks, for dealing with farmyard manure and litter, usually have three or four curved tines of circular section. Caving, cocking, or pooking forks, for collecting and loading short material, are somewhat similar, but the tines are long and wide apart, while they are continued backwards above the neck

and connected by a cross-bar, so as to prevent the forked-up stuff from falling off again.

Forli. Prov. of Emilia-Romagna, N.E. Italy, bounded E. by the Adriatic Sea and N. by the prov. of Ravenna; its area is 730 sq. m. The surface is flat and low-lying, and the soil fertile. The chief products are wine, grain, silk, and sulphur. Besides Forli, Rimini is in this prov. Pop. (1951) 481,060.

Forli. City of Italy, the ancient Forum Livii. The capital of the prov. of Forli, it stands in a fertile plain, intersected by the rivers Montone and Ronco, 40 m. S.E. of Bologna by the main rly. from Bologna to Brindisi. A walled town, it contains a cathedral (re-built), a citadel, 1361, utilised as a jail, a lyceum, technical institute, municipal art gallery, and town hall. The churches contain pictures and frescoes by local masters. A thriving trade is carried on in cattle, cereals, wine, silk, and hemp, while the manufactures include furniture, earthenware, machinery, headgear, shoes, and silk goods. Founded about 200 B.C., in the Middle Ages it was part of the exarchate of Ravenna. It experienced many vicissitudes during the quarrels of the Guelphs and the Ghibellines, and fell to the papacy in 1504. It suffered little damage in the Second Great War, British troops of the 8th army occupying it Nov. 9, 1944, after the Germans had withdrawn. Pop. (1951) 78,883.

Forlorn Hope (A.S. *fore-lioran*, to send forward, *hauife*, a troop). Military expression once signifying troops sent forward. The implication that they are to carry out a specially dangerous enterprise is a comparatively modern use of the expression. The French, Dutch, and German equivalents are *enfants perdus*, lost children, *verloren hoop*, lost troop, and *verlorner Posten*, lost post. Cromwell issued the first campaign medal to the forlorn hope, or skirmishers, of the New Model Army; it was of pewter and was worn on the hat. In hunting phraseology, a hound that follows the chase in front of the rest of the pack is referred to as a forlorn or forloyne hound. In ordinary language forlorn hope is used of any hopeless undertaking, hope being erroneously identified with hope meaning expectation, a word of entirely different etymology.

Form (Lat. *forma*). Word literally meaning shape. It denotes the manner in which the matter or parts of a whole are combined. Thus, a table or a chair may be

made of pieces of wood, but the form of a table differs from that of a chair in the arrangement of the materials. Aristotle lays down four causes or principles of being—the material, the formal, the efficient, and the final. The three last-named on examination will be found to run into one another, leaving only the opposition of Form and Matter. Matter is possibility or potentiality (*dynamis*) which becomes actuality (*energeia*) by its conversion from indeterminateness into something definite. As an adaptation of the Platonic idea, form is the realization of the ideal, e.g. of the perfect table that a carpenter has in mind. See Matter.

Form. In music, the plan of construction, or the arrangement of phrases, sections, and movements. There is no limit to the possible varieties of musical form, but a few outstanding classes may be named. Binary form has two main divisions, as exemplified in the old air Barbara Allen; ternary form has three divisions, as in Charlie is My Darling. From these two germs most of the larger specific forms have been evolved, such as the rondo, the sonata, and all their derivatives. The fugue is essentially a contrapuntal movement of continuity, but it has an underlying basis of sectional form.

Many compositions bearing other generic names are also referable to these forms; e.g. many songs and short instrumental pieces are in simple ternary form, called also primary, song, or lied form; many marches are in rondo form; the minuet and trio, in a suite, or symphony, are each in either binary or ternary forms, while together, with the recapitulation of the minuet, they constitute a larger ternary form. See Minuet; Suite; Symphony; Trio.

Formalin OR FORMALDEHYDE (HCOH). Pungent gaseous compound first prepared in 1867 by Hofmann by passing methyl alcohol vapour and air over a heated platinum spiral. A 38–41 p.c. solution of formaldehyde is known as formalin, and is the form in which the gas is obtainable in commerce. A current of air drawn by an aspirator is passed over methyl alcohol and in contact with silver gauze, formaldehyde being formed. The gas is made to pass through a series of receivers containing water, until the water is saturated with the gas. Formalin is employed as a preservative and antiseptic. Combined with ammonia, formaldehyde yields hexa-methylene-tetramine, which, under the

name of hexamine, is used as an internal urinary antiseptic.

A recent discovery in chemistry is the production of formaldehyde by the action of light upon water, in imitation of the natural process by which it is created by a plant through the agency of chlorophyll. The latter, under the influence of sunlight, extracts carbonic acid gas from the air and combines it with water to form formaldehyde and sugar. In the laboratory, carbonic acid and water under the influence of ultra violet rays are made to produce a similar result. The process is known as photo-synthesis. By using a coloured water, pure formaldehyde was obtained without sugar by Professor Baly of Liverpool. Formaldehyde can be produced industrially by the direct catalytic union of carbon monoxide and hydrogen or by the oxidation of synthetic methanol.

Formalin is a powerful caustic; when mixed with ten times its volume of water it may be used for removing corns. A 30 p.c. solution may be used for treating ringworm of the scalp, and a solution of 1 in 500 as a mouth-wash. Formalin is not much used in surgery as an antiseptic, as it tends to retard healing. It is a powerful disinfectant and has the advantage that it does not injure coloured fabrics. Formaldehyde is widely used in plastics, condensing with phenol to give bakelite and with urea and related compounds to give amino-plastics.

Formalism. In philosophy, the tendency to consider mere form or externalities as the only valuable part of anything. Thus, the adherence to cut-and-dried rules, like those of formal logic, is formalism. The same applies to the rules of composition in sculpture or painting. The term is specially used of strict adherence to religious forms and dogmas characterised by the absence of a genuine religious feeling. Formalism is rather the reduction of such forms and dogmas to a written system.

Forman, SIMON (1552–1611). English astrologer and quack doctor. Born at Quidhampton, Hampshire, Dec. 30, 1552, he entered Magdalen College, Oxford, as a poor scholar, 1573. After experience as an usher in small country schools he claimed mira-



Simon Forman,
English astrologer

culous powers, and in 1580 professed to be able to cure diseases. He studied medicine and astrology in Holland, and in 1583 started practice in London, wrote treatises on mathematics and medicine, and began to seek the philosopher's stone. Though frequently arrested, he worked among the poor in plague-stricken areas and obtained a large and far less honourable practice among court ladies; e.g. his aid was sought by Lady Essex to alienate the love of her husband and influence the affection in her favour of Somerset. Cambridge granted him a licence to practise medicine in 1603.

Richard Nicolas, in *Overbury's Vision*, 1616, thus refers to him:

Forman was that fiend in human shape
That by his art did act the devil's ape

His philtres are alluded to in Jonson's *Epicoene*, and his career suggested much in Jonson's play, *The Alchemist*. He died Sept. 11, 1611, and was buried in S. Mary's church, Lambeth. His MSS. came into the possession of Elias Ashmole. A diary, 1564-1602, was published in 1849.

Formation. In geology, an old term used to denote a group of strata or rock-beds. They are distinguished by common lithological characters, such as the Upper Greensand formation (sandstone) and Gault (clay). Modern divisions of stratified rocks are based on fossils enclosed, which often prove strata of different lithological aspect to be of same age. For these divisions "stage" names are applied. e.g. Selbornian stage, which includes both Upper Greensand and Gault formations.

Formby. Urban district, market town, and watering-place of Lancashire, England. It is 7 m. S.W. of Southport, and has a railway station. Formby is really a residential suburb of Liverpool. Near are the Altcar Flats, on which the Waterloo Cup (coursing) is decided. Pop. (1951) 10,429.

Formby, GEORGE. Stage name of James Booth (d. 1921), a British comedian. A native of Ashton-under-Lyne, he first appeared on the London music hall stage at the Royal Albert, Canning Town, in 1902. He achieved outstanding success in variety at the Tivoli by his simple Lancashire humour, his wheezy voice (long thought to be assumed, but actually due to painful pulmonary weakness which he turned to good account with high courage), and his burlesque of the familiar light comedian. He appeared in pantomime and revue, and among the songs he popular-

ized was the famous I was Standing at the Corner of the Street. He died at Warrington, Feb. 8, 1921.

His son George, who adopted the surname Formby, was born May 26, 1904. He became a jockey, but abandoned that career for the stage, playing first under the name George Hoy. From his first film in 1934 he was a popular comedian, and his later pictures included *It's in the Air*; *Trouble Brewing*; *Keep Your Seats, Please*. During the Second Great War he and his wife Beryl devoted themselves to entertaining British troops overseas, sometimes in theatres of war not visited by other artists.

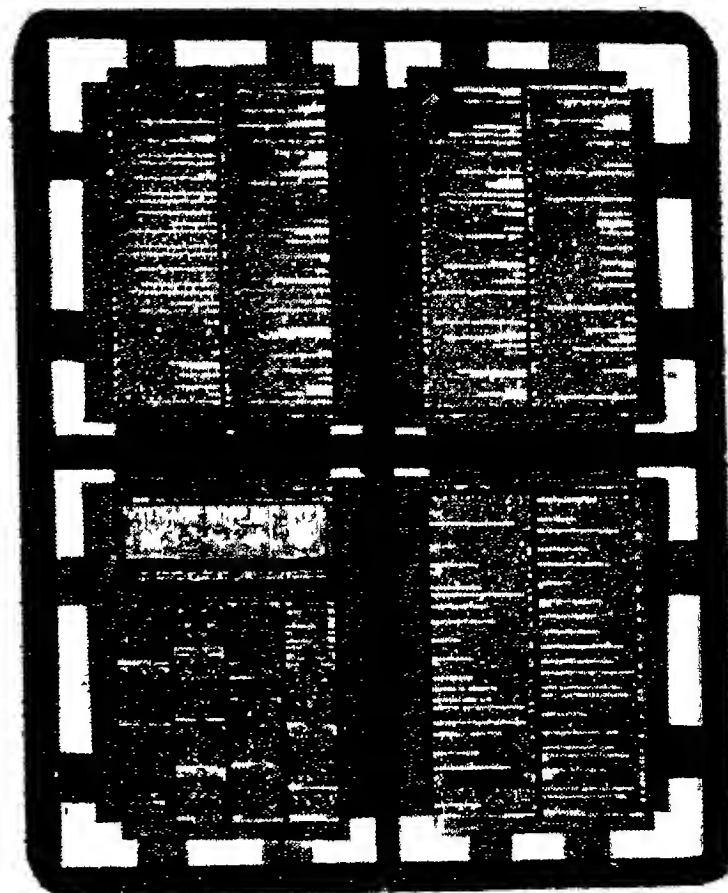
Forme. In printing, a page or number of pages of type, or stereotype plates, arranged or "imposed" for printing and secured or "locked up" in a metal frame called a chase. See *Printing*.

Formentera. One of the Balearic Islands, in the W. Mediterranean Sea, belonging to Spain. It is the smallest and most southerly of the group, and lies 7 m. S. of Iviza. Area 37 sq. m. The fertile soil yields abundant wheat. Fishing and salt-working are engaged in.

Formia. Town of Italy, in the prov. of Latina, on the site of the ancient Volscian town of Formiae. Situated on the N. side of the Gulf of Gaeta, 48 m. by rly. W.N.W. of Caserta, it is a seaside resort. The town has a little trade in olive oil and earthenware, and the surrounding districts yield an abundance of fruit. During the Second Great War the Germans looted the choir and sacristy of the church of S. Erasmo, and the best objects in the museum were removed to Naples, where they were destroyed. American troops of the 5th army captured Formia May 18, 1944. Pop. (1951) 17,737.

Formiae stood on the Appian Way and was a residential district for wealthy Romans, remains of whose villas stud the coast. Here Cicero lived, and met his death, near his villa, Dec. 7, 43 B.C.

Formic Acid (Lat. *formīca*, ant). The lowest in the important series of fatty acids. Its chemical formula is CH_2O_2 . It was first obtained by John Ray in 1670 by



Forme. Four pages of type locked up in a chase, making a forme ready for printing

distilling red ants with water, his observations being printed in the *Philosophical Transactions* of that year. Formic acid occurs in other animal and vegetable substances, but is now made by (1) heating to 60° C. in a retort a mixture of sugar, water, manganese peroxide, and sulphuric acid; (2) heating equal parts of anhydrous glycerine with oxalic acid and distilling the product. It has been used in the treatment of rheumatism, as it was observed that those liable to bee stings often found relief from rheumatic pain.

Formication. Sensation of insects crawling under the skin, a disorder of the sensory nerves resulting from prolonged intake of certain toxic substances, e.g. cocaine.

Formicivora (Lat. *formīca*, ant; *vorare*, to devour). Genus of passeriform birds of the family Pittidae. They are long-legged birds and are widely distributed geographically.

Formigny, BATTLE OF. Fought between the English and the French, April 15, 1450. To strengthen the English cause in France a force under Sir Thomas Kyriel was sent to Cherbourg. About 2,500 strong, it was joined in Normandy by another 1,000 men, and this army, having taken Valognes, moved to Formigny, near Bayeux. There it was met by a French force and was routed.

Formosa OR TAIWAN. Island province of China, off the S.E. coast. Formosa was Chinese territory from 1683 until 1895, when after the Sino-Japanese war it was ceded to Japan. The island proved

deemed to be German. Following the defeat of Germany he was captured at Hamburg by the 53rd Welsh div. late in May, 1945, and was handed over to the Polish government in Aug., 1946.

Forster, EDWARD MORGAN (b. 1879). A British man of letters. Born Jan. 1, 1879, and educated at Tonbridge and King's College, Cambridge, he published his first novel, *Where Angels Fear to Tread*, in 1905. Then in *The Longest Journey*, 1907; *A Room with a View*, 1908; and *Howard's End*



E. M. Forster,
British novelist

1910, he dealt with the interaction of two types of character, those who live by convention and those who live by instinct. His masterpiece, *A Passage to India*, 1924, again emphasising the importance of personal relations, was awarded the Femina Vie Heureuse and James Tait Black Memorial prizes. In 1927 he was Clark lecturer at Cambridge, when he dealt with *Aspects of the Novel*, and in 1937 he published a collection of essays, *Abinger Harvest*. His biographies of G. Lowes Dickinson, 1934, and of Marianne Thornton (his aunt), 1956, were remarkable in that he made undramatic life stories intensely interesting. As a short story writer Forster occupied a high place, his best-known collections being *The Celestial Omnibus*, and *The Eternal Moment*. He was made C.H. in 1953. His quiet, clear speech and his wit made him an acceptable speaker and broadcaster. *Consult* Life, L. Trilling, 1944.

Forster, JOHN (1812-76). A British historian and biographer. Born at Newcastle, April 2, 1812.



John Forster,
British historian
After C. E. Perugini

and educated at Newcastle grammar school and University College, London, he became, in 1833, the literary and dramatic critic of the *Examiner*, and edited the *Daily News* in 1846. During 1847-55 he edited the *Examiner*, resigning on his appointment as secretary to the commissioners of lunacy. From 1861 to 1872 he was one of the commissioners. He died Feb. 1, 1876.

Forster is best known for his *Life and Times of Oliver Goldsmith*, 1848; and *Life of Dickens* (of whom he was the intimate friend and correspondent for over 30 years) 1872-74. He also wrote *Lives of the Statesmen of the Commonwealth*, 1836-39; *Arrest of the Five Members*, 1860; *Life of Sir John Eliot*, 1864; and vol. i of a *Life of Swift*, 1875. His collection of MSS., books, and pictures forms the Forster bequest at the S. Kensington Museum.

Forster, WILLIAM EDWARD (1818-86). British politician. Born at Bradpole, Dorset, July 11, 1818. his parents were Quakers, and he was educated at a Quaker school at Tottenham. In Bradford he became a successful woollen manufacturer. He found time also for public work; writing and lecturing made him known, and in 1861 he was returned as Liberal M.P. for Bradford. He retained the seat throughout his life.



W. E. Forster,
British politician

In 1865 Forster joined the Liberal ministry as under-secretary for the colonies, but he was soon in opposition. In 1868 he became vice-president of the council in Gladstone's first ministry. It fell to him to frame and introduce the important Education Act of 1870. He remained in office until 1874, and in 1880 returned to the difficult position of chief secretary for Ireland. In 1882 he resigned, as Gladstone released the political prisoners from Kilmainham, and it was not surprising when he declared against Home Rule. On April 6, 1886, he died at his London residence. *Consult* Life, Sir T. Wemyss Reid, 1888.

Forsterite. The magnesian end-member of the olivine series of minerals; magnesium silicate (Mg_2SiO_4) in light-coloured orthorhombic crystals. It occurs in volcanic rocks or as a contact mineral in dolomite altered by igneous intrusion. *See* Olivine.

Forsyte Saga, THE. Sequence of novels by John Galsworthy. The original "saga" comprised three long stories: *The Man of Property* (1906), *In Chancery* (1920), and *To Let* (1921), with two linking short stories. These, reissued in one vol., 1922, as *The Forsyte Saga*, depict very fully the history of a large London family of the wealthy and apparently secure

middle-class between the years 1886 and 1920, which has considerable value as a social document apart from its merit as a study of human motives. The history was extended to later years in three further novels: *The White Monkey* (1924), *The Silver Spoon* (1926), and *Swan Song* (1928), which were reissued in 1929, again with two short stories, as *A Modern Comedy*. Even then, though the Forsyte story was completed, some of the characters were carried over into other books, viz. *Maid in Waiting*, 1931, *Flowering Wilderness*, 1932, *Over the River*, 1933. There were also several disconnected short stories about the Forsytes, many of them being collected into the volumes *On Forsyte's Change* (1930) and *Forsytes, Pendycyes and Others* (1935). The success of the original *Saga*, a new experiment in publishing, led directly to a fashion for "omnibus" volumes of all kinds containing three or more separate books. *See* Galsworthy, John; Omnibus Books.

Forsythia. Genus of shrubs of the family Oleaceae. Natives of Japan and China, they have smooth, simple, or trefoil leaves, and scattered yellow flowers, abundantly produced in early spring, which makes the two species, *F. suspensa* and *F. viridissima*, favourites in European gardens. The genus is named after William Forsyth, an 18th century gardener.

Fort (Lat. *fortis*, strong). Fortified place of small size, surrounded by a ditch, moat, rampart, stockade, or other means of defence, and garrisoned with a small body of troops. Fort is a diminutive of fortress and sometimes refers to a small castle. The term was applied to trading posts set up by Europeans in N. America, Africa, and India; some rough shelter and protection was thrown up, and the fort served as a storehouse and rendezvous for the traders, and, in attacks, as a refuge. During the Franco-British wars in India in the 18th century the existing forts were strengthened and new ones erected. Forts are still used as defence points on the N.W. frontier of India. Some leading examples in both N. America and India developed into towns and retained the prefix, e.g. Fort Duquesne. In its modern sense, fort means part of a general system of fortifications. *See* Fortification; Fortress.

Fort, PAUL (b. 1872). French poet. Born at Reims, Feb. 1, 1872, he settled in Paris, where he

founded in 1890 the Théâtre des Arts for modern plays, *e.g.* by Verlaine and Maeterlinck. Fort also edited the Symbolist review, *Vers et Prose*. The first volume of his *Ballades Françaises* appeared in 1897, and was followed by over 30 more, under the same title, establishing Fort's reputation as one of the outstanding contemporary French poets. He was influenced to some extent by Laforgue, but intensely individual, using rhythmic prose as his medium. He also wrote plays, and a stimulating *Historie de la Poésie Française* depuis 1850 was published in 1926. *Pron.* for.

Fortaleza. Alternative name of the capital of the state of Ceará, Brazil, also called Ceará (*q.v.*).

Fort Augustus. Village of Inverness-shire, Scotland. It is finely situated at the head of Loch Ness, on the Caledonian Canal, and is connected with Spean Bridge, 24 m. S., by a branch railway line. The fort, built originally in 1716 and enlarged in 1730, was taken by the Jacobites in 1745, and recaptured a year later by William Augustus, duke of Cumberland, in whose honour it was named. Purchased by Lord Lovat in 1857, it was presented by him in 1876 to the Benedictines, who transformed it into a monastery with college, hospital, and scriptorium, which in 1882 was raised to the rank of an abbey.

Fort Bayard. Town and port of Kwangtung, S. China. Situated on the N. shore of Mandarin Bay, the town was formerly the administrative centre of that portion of French Indo-China leased from China. This territory was restored to China in Feb., 1943, and occupied by Japanese forces in the same month. There is an aerodrome near the town, which has steam communication with Hong Kong, Macao, and Canton. Pop. 20,000.

Fort Beaufort. Town of Cape Province, S. Africa. It is on the Kat river, 63 m. by rly. W.N.W. of King William's Town, and is an important cattle-rearing and dairy-farming centre; oranges are grown near by. Pop. (1951) 8,258.

Fort Belvedere. Royal estate in Berkshire, England. Between Ascot and Sunningdale, 6 m. S. of Windsor, Fort Belvedere was completed in 1746 as a look-out post for troops returned from quelling the Jacobite rebellion and encamped in Windsor Great Park. In 1750 it became the official residence of the duke of Cumber-

land (*q.v.*) in his capacity as Ranger of Windsor Park. The duke mounted on its battlements the battery of 4-pdr. guns which had been used at Culloden; these guns are still at the fort and until Victorian times fired royal salutes. Fort Belvedere was converted into a country house by George IV. In 1932 it became the country seat of the prince of Wales, who as Edward VIII here signed his instrument of abdication on Dec. 11, 1936.

Fort Capuzzo. This Libyan fortress of the Second Great War is noticed under Capuzzo.

Fort-de-France. Town of Martinique, French W. Indies, formerly known as Fort Royal. On the W. coast, 15 m. S.E. of St. Pierre, it is the capital and chief commercial centre of the colony. Its commodious harbour is fortified, and it has an arsenal, law and commercial colleges, a library, and several hospitals. In the chief square there is a statue of the Empress Josephine. In Aug., 1891, the town was laid in ruins by a cyclone. Pop. (1954) 60,648.

Fort Donelson, BATTLE OF. Federal victory in the American Civil War, Feb., 1862. Fort Donelson and Fort Henry, situated 12 m. apart on the Kentucky-Tennessee border, were the two most important defences of the West, occupied by the Confederates in 1861. Grant immediately recognized the necessity of capturing them, and succeeded in seizing Fort Henry, although most of its defenders had escaped to Fort Donelson.

Moving against the latter with a combined naval and military force, Grant received a serious check, and on Feb. 15 the Confederates made an attempt to retreat to Nashville, but were stopped by Grant. The following day Buckner, in command of the fortress, asked for an armistice in which to settle terms of capitulation. Grant demanded unconditional and immediate surrender, to which Buckner agreed. This reply of the Federal general and the play upon the initials of his Christian names, U. S., gave him the sobriquet of Unconditional Surrender Grant.

Fort Duquesne. Eighteenth century stronghold in Pennsylvania, at the junction of the Monongahela and Allegheny rivers. During the French and English disputes about the sovereignty of the land W. of the Alleghenies, George Washington recommended the spot as a suitable site for a fort, and in 1754 the English began to construct one. The French

drove them away and themselves completed the work, calling it Fort Duquesne, after the French governor of that name. Attempts by Washington, and in 1755 by General Braddock, failed to recover it; but in 1758 General John Miles succeeded. He arrived there to find that it had been abandoned and destroyed. The English then began to build Fort Pitt, which grew into Pittsburgh (*q.v.*).

Forte. Italian term used in music, meaning strong or loud. It is sometimes represented by the abbreviations *for.*, or *f.* Its superlative, meaning very loud, is *fortissimo*, shortened to *ff* or *fff*, or very rarely *ffff*. See Musical Terms.

Fort Erie. Town of Ontario, Canada, on the opposite side of the Niagara river from Buffalo, U.S.A. It is 100 m. S. of Toronto by C.N.R., C.P.R., and other rlys. Abundant water power is used for industries, which include steelworks and aircraft factories. Pop. (1951) 7,572.

Fortescue. River of W. Australia. It rises in the Hammersley Range, flows in a N.W. course of 250 m., and discharges into the Indian Ocean in lat. 21° 10' S., a few miles below Cape Preston.

Fortescue, Sir JOHN (c. 1394-1476). English judge and writer. Though belonging to the Devon



Sir John Fortescue,
English judge
After W. Faithorne

family of that name, he was born at Norris, Somerset. He was educated at Exeter College, Oxford, and became a lawyer in London. In 1442 he was made chief justice of the king's bench, and he held the post until Henry VI lost his throne in 1461. He went abroad with Queen Margaret of Anjou in 1463, and was with her and her son Edward for some time, but in 1471 he was pardoned by Edward IV. Fortescue is best known by his writings. His treatise on the laws of England (*De Laudibus Legum Angliae*) was published after his death, and several times since. He also wrote a book, the earliest of its kind, now known as *The Governance of England*. This was first published in 1714 as *The Difference Between an Absolute and a Limited Monarchy*, and under its other title, with an introduction by C. Plummer, in 1885.

Fortescue, Sir JOHN WILLIAM (1859-1933). British military historian. Born Dec. 28, 1859, a

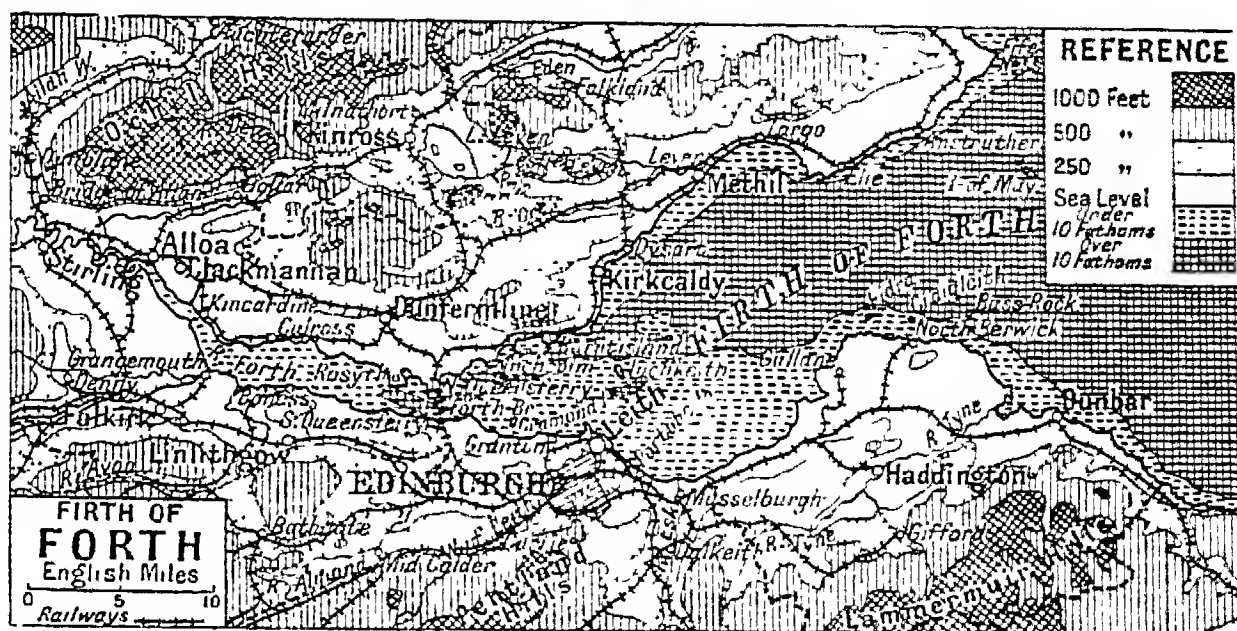
younger son of the 3rd Earl Fortescue, he was educated at Harrow and Trinity College, Cambridge. He was private secretary to the governor of New Zealand, but devoted much time to military history. In 1899 appeared the first volume of his *History of the British Army*; in all, 13 volumes were needed to complete this monumental work in 1930. This is the most complete history of its kind, and particularly valuable for the 18th century. Fortescue was librarian at Windsor Castle, 1905-26. He also wrote a *History of the 17th Lancers*, 1895, and an animal study, *The Story of a Red Deer*, 1897. Lecturer on military subjects at the universities of Oxford, Cambridge, and London, he received the K.C.V.O., 1926. He died Oct. 22, 1933.

Fort Garry. A former post of the Hudson Bay Co., erected 1835, on the site of which Winnipeg (*q.v.*) grew up. In 1873 the city was incorporated under the latter name. Old Fort Garry Gate, a castellated gate at the end of Broadway, is all that remains of the fort. A mounted unit of the Canadian army known as the Fort Garry Horse distinguished itself at Cambrai, Nov. 20, 1917.

Fort George. Fortress of Inverness-shire, Scotland. It stands on Moray Firth, 12 m. N.E. of Inverness, and was erected after the rebellion of 1745 to accommodate 2,000 men, and improved in 1784. There is ferry communication with Fortrose on the opposite shore of the Firth.

Forth. A river of Scotland which, flowing into the North Sea, forms as its estuary the Firth of Forth. The meeting of the hill streams Duchray Water and Avon-dhu, near Aberfoyle, Perthshire, forms the Forth, which flows through Perthshire, Stirlingshire, and Clackmannanshire, mainly in an easterly direction. The total length as far as Alloa is about 53 m. Tidal to a point about 4 m. above Stirling, the river is navigable for 300-ton vessels as far as Alloa, for 100 tons to Stirling. Its chief tributaries are the rivers Teith and Devon and Allan Water. In the Carse of Stirling its course is extraordinarily sinuous, forming the so-called Links of Forth.

Forth, FIRTH OF. Name given to the estuary of the river Forth, on the E. coast of Scotland. The Firth begins at Alloa, and stretches to a line drawn S. from Fife Ness, being thus about 51 m. long and varying in width from one to 17 m. The chief islands are Inch-



Firth of Forth. Layered map showing the heights of the surrounding hills and depths of the estuary

keith, Inchcolm, Cramond, and the Bass Rock. Leith, Granton, Grangemouth, Alloa, Burntisland, and Methil are the chief harbours and fishing ports along both coasts. The Firth is spanned at Queensferry by the Forth (rly.) Bridge, and a swing road bridge at Kincardine-on-Forth, opened in 1936. A ferry service is maintained at Queensferry between Granton and Burntisland.

The Firth has great strategic importance. During the First Great War it was a base of the Grand Fleet; defences, forts, protective booms, etc., were constructed, and in the Firth off Inchkeith the German fleet surrendered, Nov., 1918. The first German air raid on Great Britain during the Second Great War occurred in daylight on Oct. 16, 1939, in this area, ships of the Royal Navy being attacked off Rosyth. R.A.F. aeroplanes engaged German aircraft over the mainland for the first time in this action. See Rosyth.

Fort Hall. Settlement in Kenya, E. Africa. It is situated between Nairobi and Mount Kenya, and is 4,500 ft. above sea level. A branch line from the Uganda rly. at Nairobi links it with Nanvuki.

Forth Bridge. Railway bridge in Scotland, begun in 1882 and opened for traffic in 1890. By its construction across the Firth of Forth, from S. Queensferry to N. Queensferry, a long detour of the rly. westward was obviated and direct connexion between Edinburgh and the N. side of the Firth established, while its clear height of 150 ft. and long spans give headway for vessels of any size or type.

From the engineer's point of view, it marked an epoch in the history of bridge building. Its enormous clear spans of 1,710 ft. between supports were rendered possible by the use of steel and by the cantilever design of the superstructure. The bridge, which carries

two railway tracks, slightly exceeds $1\frac{1}{2}$ m. in length. There are three main piers from which the six cantilever arms rise and project, the ends of which, in the main spans, support and are connected by long girder spans. The height of the cantilevers, over the piers, above water level is 361 ft. The extremities of the end cantilevers rest upon masonry piers whence the rly. is carried to the shore on approach viaducts comprising a number of comparatively small steel bridge spans and masonry arches. Each main river pier consists of four circular masonry supports resting upon caissons 70 ft. in diameter, and sunk to a depth of from 70 to 90 ft. below water level.

The structure, designed by John Fowler and Benjamin Baker, comprises 51,000 tons of steelwork and 142,000 cubic yds. of masonry, cost nearly £3,000,000, and took seven years to construct. On Oct. 16, 1939, German aircraft attempted to bomb it in their first raid on the U.K. in the Second Great War. See Bridge illus. p. 1422.

Fortification (Lat. *fortificare*, to make strong). Art or science of strengthening a town or other position in order to defend it against an enemy. The essential feature of fortification is some kind of wall. Primitive man often protected his villages by earth banks on top of which he set up palisades of strong stakes. Outside the bank, the ditch from which the earth had been taken added to the strength of the position. When possible the village was built on a hill top, and many such primitive hill-forts of great strength are known (see Hill-fort). As the art of fortification advanced, the number of ramparts was increased, and entrances were made very elaborate (*cf.* Maiden Castle, Dorset). In stony country, the

primitive rampart would be of stones, gradually becoming more regular in construction as building developed. The *muris gallicus*, used in Gaul in the time of Caesar, was of stones built up around a framework of beams.

The remains of town walls in Babylonia and Assyria show their mastery of military engineering. Projecting towers, giving the defenders a chance of enfilading attackers, were an early improvement. The long sieges of Tyre and Carthage attest the strength of their fortifications—against the offensive weapons of antiquity.

Every night the Roman army on campaign protected itself by an entrenched camp. Roman town walls were strong and high, well furnished with fortified gateways and towers. In the early days the standard Roman fort had an earth rampart with a wood revetment, or breastwork, and one or more ditches. In time stone instead of wood was used for the revetment; later still walls were built of concrete and rubble, and faced with dressed stone. The towers were designed to hold the artillery of the day. In the perilous times of the late empire walls became thicker and towers larger.

Medieval fortifications followed the late Roman pattern. The fortress of Carcassonne, fortified by the Visigoths in the 5th cent. on the Roman model and rebuilt in the 13th, remains a monument to the medieval engineer. Towards the close of the 15th cent. the increasing fire power of artillery rendered Roman and feudal defences obsolete. High, massive walls offered too great a target for concentrated fire; while the besieged could fire effectively only if they sited guns near the walls.

Vauban's Developments

Accordingly bastions were built to project from the curtain wall. The bastion had two faces and two flanks, enabling a cross fire to be directed against the massed artillery of the besiegers, while fire from the flanks of the bastion raked any frontal infantry assault. Ravelins or outworks were added, which during the 16th–17th centuries were extended until they culminated in the step-by-step defence system initiated by the French engineer Vauban (1633–1707). Until Vauban's day, little effort was made to adapt the defences to the topographical features of the site. Vauban retained thick masses of masonry to withstand heavy artillery fire, but added

secondary lines of defence on which the garrison, if driven back, could still resist. Vauban thus anticipated the principle of defence in depth ultimately exemplified in the Hindenburg Line of 1917 and the Siegfried Line of 1939.

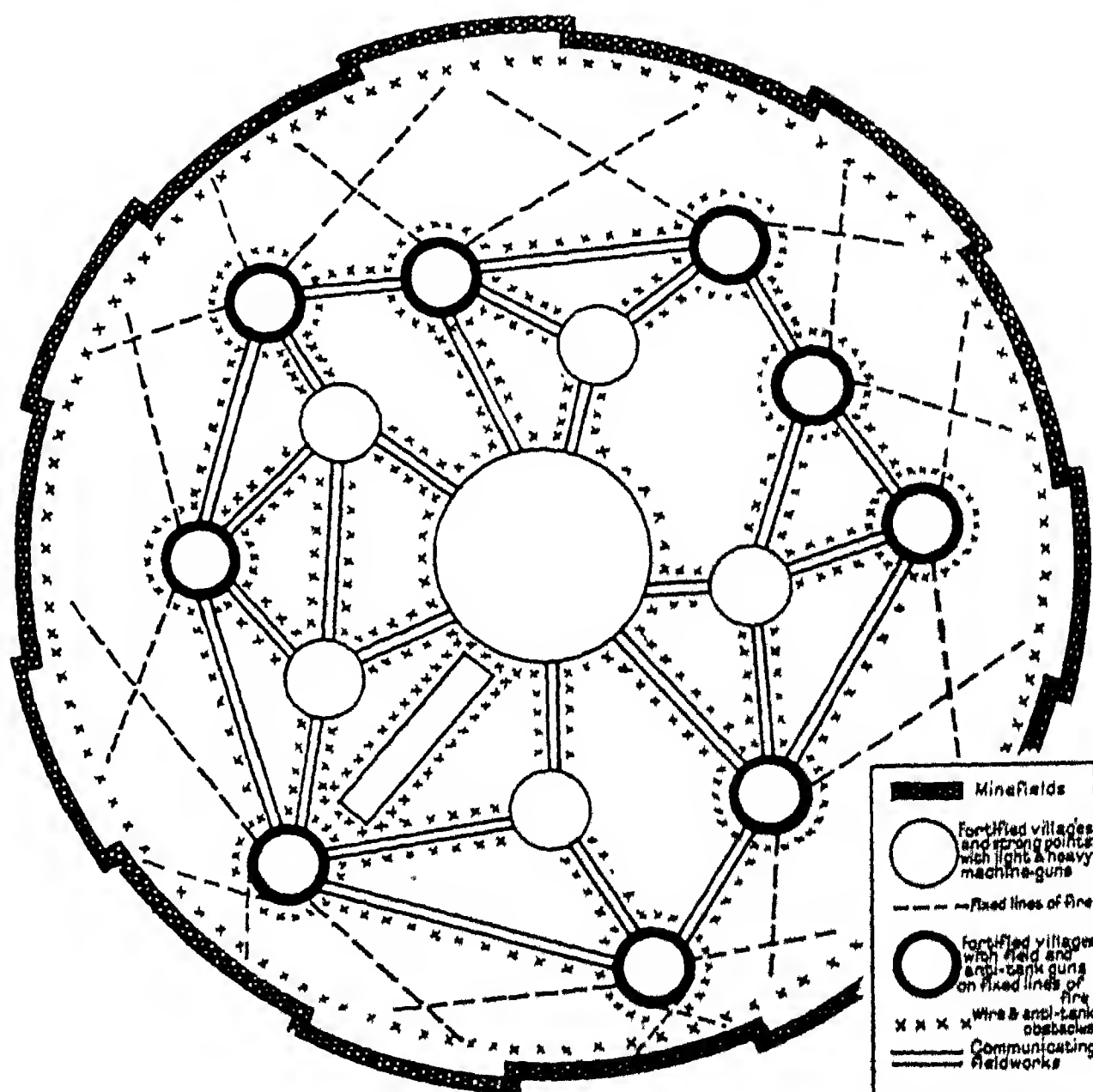
Vauban's theory of fortification continued throughout the campaigns of Marlborough and the Napoleonic Wars. Rapid development of artillery in the 19th century brought a great change. The rifled gun, with its greater range and penetrating power, made it necessary that the enceinte or circumvallation should be more amply defended. Therefore several small fortresses were placed in front of the main defences and sufficiently close to each other to give mutual support against attack.

The Franco-Prussian War, and particularly the siege of Paris, 1871, showed the uselessness of stone bastions and ramparts against modern artillery. Reinforced concrete and steel became the new material, with armoured cupolas and turrets for the artillery. That properly designed fortifications of this type could withstand high explosive was proved during the attack on Port Arthur by the Japanese in 1904. Port Arthur's fortifications included all the latest developments in armoured gun positions and

successive defence perimeters. Despite the use of 11-in. siege guns and the launching of repeated infantry assaults, they withstood a five months' siege, and fell only after the forts had been undermined by constant sapping.

In the First Great War

By 1914 the gun had regained the ascendant, as was proved by the rapid fall of the Belgian fortifications under the fire of the German 17-in. siege gun. Liège, with its 12 armoured fortresses, fell in 11 days; Namur after four days' bombardment; the Antwerp forts in three. Manonville, on the French frontier, lasted only two days. Yet the obsolete fortifications at Verdun sustained tremendous punishment from artillery and were never reduced, though it was the trench lines of the advanced positions that actually stopped the Germans. Later in the First Great War both sides relied on field fortifications rather than fixed fortresses of steel and concrete. The former can be rapidly built in accordance with the latest tactical ideas; sited in positions most suitable at the time; better concealed from aerial observation; and provide greater opportunity for defence in depth. Exceptionally thick strong-points, or pill boxes, of reinforced concrete, are interspersed with minefields, wire entanglements, and



Fortification. Schematic diagram of a theoretical modern fortified position, giving all-round defence, without allowing for natural ground features

tank traps, while no section of the defences offers a large target to artillery or bombing aeroplanes. These principles were first applied on a large scale in the Hindenburg Line (*q.v.*).

Despite the lessons provided by the losses of their walled fortifications in 1914, both France and Belgium continued to rely upon that type for their defence; and the Germans adopted similar defences in their attempt to protect the Continent from invasion. The new Belgian system, the Albert Line, was breached by the Germans in the first rush of May, 1940, though the enemy's rapid successes were aided by the treachery of the defenders. France pinned her faith to the Maginot Line (*q.v.*), which embodied the latest theories of static defence in line. It is doubtful if the Maginot Line could have been carried by direct frontal assault; it fell because it was outflanked. But it lacked defence in depth, and had the Germans carried the main system the French resistance must have collapsed as there were no rear defence lines on which the French army could have fallen back.

Germany's Siegfried Line (*q.v.*) did afford defence in depth, having successive lines of gun positions, minefields, and tank traps. Had the Germans decided to hold it they might have delayed the Allied advance in 1945, but they were concentrating resistance on the Rhine. That the power of attack can overcome the strongest fortifications sited to the greatest disadvantage of the attackers was proved by the Allied assault on Germany's Atlantic wall in June, 1944. The attack was launched from the sea, one of the most difficult military operations, but air and artillery bombardment, particularly by the rocket gun, reduced all but the strongest positions to rubble, and broke the morale of the defenders sheltering in the depths of their emplacements.

The fortress system generally has become obsolete, and except in very favourable circumstances even defence in depth can do little more than delay an enemy well equipped with armour and heavy artillery. The invention of the flail tank, which clears the minefields, and the flame-throwing tank, which can burn out concrete and armoured positions, again gave the ascendancy to the attack. Russia halted the German advance in 1942 by means of the fortified zone—strongly defended islands of

resistance called hedgehogs (*q.v.*). But when the Germans tried to stem the Russian advance into the Reich by a similar system, armour and air power overwhelmed them.

Fortingall. Village of Perthshire, Scotland. It stands on the Lyon, 8 m. W. of Aberfeldy, and is a centre for tourists visiting Glen Lyon and Loch Tay. It has a fortification thought to be Roman, possibly prehistoric; a yew tree reputed 3,000 years old; and some regard this village as the birthplace of Pontius Pilate. Pop. 1,629.

Fort Jameson. Settlement, until 1910 h.q. of the administration, of N.E. Rhodesia. On the Tanganyika plateau in a tobacco farming area it is 125 m. W. of Lake Nyasa. It has an airfield.

Fort Johnston. Settlement of Nyasaland, Central Africa, 6 m. S. of Lake Nyasa. It is a trading post.

Fort Knox. U.S. gold depositary. See Knox, Fort.

Fort Lamy. Capital of Chad territory, French Equatorial Africa. Situated on the Shari just below its confluence with the Logone and S. of Lake Chad, it is a centre of communication, for from it radiate roads to the lake, to Kano, Abeshr, Fort Archambault, Carnot, Yaoundé, El Obeid, and Khartum. It is the headquarters of the lieutenant-governor of the territory. During the Second Great War it was a vital link for the Allies in air communication between W. and E. Africa and Egypt; its airfield was a refuelling station. Fort Lamy was also the base from which Fighting French forces attacked Italian outposts in the Libyan desert and whence General Leclerc's column set out to join the British 8th army in Tripoli, Jan., 1943. It was attacked by Axis aircraft but suffered little damage. Pop. (est.) 23,000.

Fortnightly Review, THE. London monthly review first published as a fortnightly, May, 1865, under the editorship of G. H. Lewes, and the chairmanship of Anthony Trollope. John Morley became editor in 1867, and made it a monthly. Its contributors have included J. S. Mill, T. H. Huxley, Herbert Spencer, Swinburne, Barrie, H. A. L. Fisher, Wells, Julian Huxley, J. Middleton Murry, W. R. Inge, Dorothy L. Sayers, and Harold Laski.

Fort Peck Dam. Dam on the Missouri river in N.E. Montana, U.S.A. Built by the U.S. engineer corps, it was begun in Oct., 1933, and completed in Oct., 1940.

This largest earth-fill in the world has a total crest length of 4 m. and a maximum height of 250 ft. It comprises a main section across the river valley of 10,578 ft. and a large dyke section on the W. bank 10,448 ft. long. The average width of the base is 3,500 ft., and the top, carrying a hard road, is 100 ft. wide. The dam contains 123,000,000 cu. yds. of earth, 7,000,000 cu. yds. of gravel, and 1,000,000 cu. yds. of rock. Four tunnels by-pass water releases from the reservoir. A power plant at the outlet of one tunnel is equipped with three turbo-generators having a combined capacity of 105,000 kilowatts. The water release from the other three tunnels maintains a navigational level on the Missouri.

Fort Portal. Chief centre of the Toro district, Uganda. It is a missionary station and native town about 25 m. N.W. of Mt. Ruwenzori. Pop. 25,000.

Fortress (O. Fr. *forteresse*, from Lat. *fortis*, strong). Permanent military strong-point, sited, garrisoned, and equipped to provide a point of resistance in case of attack, and to act as a rallying point for troops who may be compelled to fall back from more exposed positions. The earliest fortress was a palisade enclosure, such as is still employed by primitive peoples in tribal warfare. The Saxon fortress was an artificial mound enclosing a number of huts, in which the local population sought refuge in time of war. The Romans also used mound enclosures or fortified camps, but these developed into elaborate systems of fortification.

Most early fortresses were built of earth and wood, and it was not until the rise of the feudal system that stone fortresses were built on any great scale. The typical feudal fortress consisted of a large walled space, protected by a moat, and could be entered only through a strongly defended gate. Later the walls were machicolated, and corner towers were added to allow of flanking fire along the walls. With the development of artillery the individual fortress became generally obsolete. See Fortification.

Fortress. Official British name for the heavy bomber known to the U.S.A.A.F. as Flying Fortress (*q.v.*).

Fortrose. Royal burgh and seaport town of Ross and Cromarty, Scotland. It stands on the Moray Firth, 9 m. N.E. of Inverness, on a branch railway line. There is a small harbour, and the fine

scenery, bathing facilities, and golf links attract many visitors. Fortrose was formerly the seat of the bishops of Ross, but the episcopal palace and cathedral were destroyed by Cromwell, who built his fort at Inverness with the stones. Pop. (1951) 882.

Fort Royal. Former name of the town of Martinique, French W. Indies, now known as Fort-de-France (*q.v.*).

Fort St. David. Ruined fort of Madras, India, in the S. Arcot district. It is on the Coromandel coast, less than 2 m. E. of Cuddalore New Town. At one time the site of Dutch and French settlements, the fort was bought by the English in 1690, together with the land within the radius of a "random shot of a great gun." The gun was actually fired, the shot indicating the extent of the boundaries. The name is supposed to have been given to the fort by a Welsh governor. The fort was captured by the French in 1758, who demolished the fortifications, but after changing hands again twice, it was finally restored to the English in 1785.

Fort Sumter. Fort in S. Carolina, U.S.A. It stands on a shoal at the entrance to Charleston

harbour, 3 m. S.E. of Charleston. It was bombarded by the Confederates, April 12, 1861, and surrendered the following day, the action immediately leading to the opening of the Civil War. In April, 1863, it was violently bombarded by the Federal fleet in the first of a series of naval and land assaults which ruined it by October.

Fortuna. In Roman mythology the goddess of chance or good luck. There were several temples in Rome erected in her honour, but the most famous seats of her worship were Antium and Praeneste. She is also called Fors Fortuna. In art she is represented with a rudder as symbol of her guidance of things, also with a cornucopia as a symbol of the prosperity she brought to mankind.

Fortunate Isles. Alternative name for the Islands of the Blessed, or the Elysian Fields, of early Greek

mythology. They were supposed to be at the edge of the earth, and were vaguely spoken of as beyond the Pillars of Hercules, *i.e.* the Straits of Gibraltar. It has been generally accepted that the Canary Isles are the Fortunate Isles of the ancients. Ben Jonson produced a masque entitled *The Fortunate Isles* in 1626. See *Elysium*.

Fortunatus. Character of a folk-tale found among many different races. It first appeared in print in a German form in 1509. Fortunatus is possessor of an inexhaustible purse, a wishing cap, and other marvels in different variants of the tale. The moral goes to show the little value to be put upon material treasures. The story was dramatised in Germany by Hans Sachs, 1553, and in England by T. Dekker, 1600. One named Fortunatus succoured the Apostle Paul.

Fortunes of Nigel, THE. Fifteenth of the *Waverley* novels, published in May, 1822. In it Sir Walter Scott followed his masterly portraits of Mary Stuart and Elizabeth Tudor with an equally brilliant character-study of James I, and supplied vivid pictures of early 17th century London, from Alsatia to the Court. Nigel Olifaunt, Lord Glenvarloch, the young Scottish

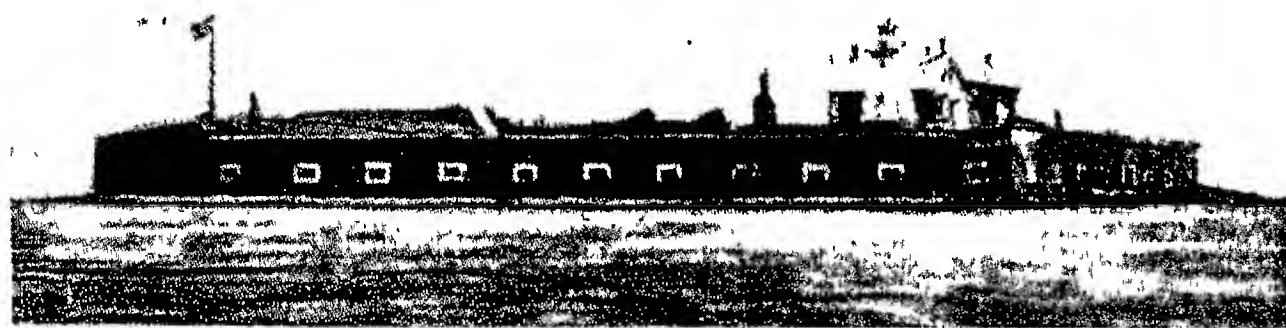
palmistry, astrology, crystal-gazing, lot-casting by cards or otherwise, and subjective processes.

The alien origin of fortune-telling in Britain is confirmed by the fact that it is not a common-law offence. Its punishment as a form of witchcraft by death, under a statute of 1563, was reduced by the Witchcraft Act, 1735, to imprisonment for one year and the pillory. Under the Vagrancy Act, 1824, any person who undertakes to tell fortunes, or uses any subtle craft, means, or device, by palmistry or otherwise, to deceive and impose upon any person, is liable to imprisonment as a rogue and vagabond. It was held in one case that intention to deceive was a necessary part of the crime, so that a person who honestly believed in his powers of prediction could not be convicted, but this was later overruled. Spiritualist mediums have also been convicted. See *Divination*; *Palmistry*.

Fortune Theatre. A London playhouse, in Russell Street, W.C.2. It was opened in 1924, and presented such notable plays as O'Casey's *The Plough* and the Stars, Lonsdale's *On Approval*, and Chekhov's *The Seagull* and *The Three Sisters* (Komisarjevsky's productions). After being (in conjunction with Drury Lane) the headquarters of *Ensa (q.v.)*, it was reopened in 1946. The theatre has a seating capacity of 493.

Fort Wayne. City of Indiana, U.S.A., the co. seat of Allen co. At the confluence of the St. Joseph and St. Mary rivers, which here merge into the Maumee river, it is 105 m. N.E. of Indianapolis and is served by several rlys. and two airports. It contains Concordia College and several schools and institutions. An important rly. and trading centre, in a hardwood timber region, it has rly. workshops, flour mills, foundries, and chemical, piano, and soap factories, as well as making engines, machinery, oil tanks and pumps, and furniture. On the site of a fort built in 1794, Fort Wayne received a city charter in 1840. Pop. (1950) 133,607.

Fort William. A police burgh and tourist resort of Inverness-shire, Scotland. It stands on the E. shore of Lower Loch Eil, at the foot of Ben Nevis, 65 m. S.W. of Inverness, on a branch railway line. The town was known as Inverlochy when Montrose defeated the Covenanters, Feb. 2, 1645. The fort, erected by Monk in 1655 and rebuilt by Mackay in



Fort Sumter. The island fortress at the entrance to Charleston Harbour, the scene of fighting in the American Civil War

nobleman who comes south to petition the king; his devoted servant, Richie Moniplies; the profligate Lord Delgarno; the crabbed old courtier Sir Mungo Malagrowth; "Jingling Geordie" Heriot, the wealthy goldsmith; Margaret Ramsay, the modest but courageous heroine; and the unhappy ship-chandler, John Christie, are memorable characters in the work.

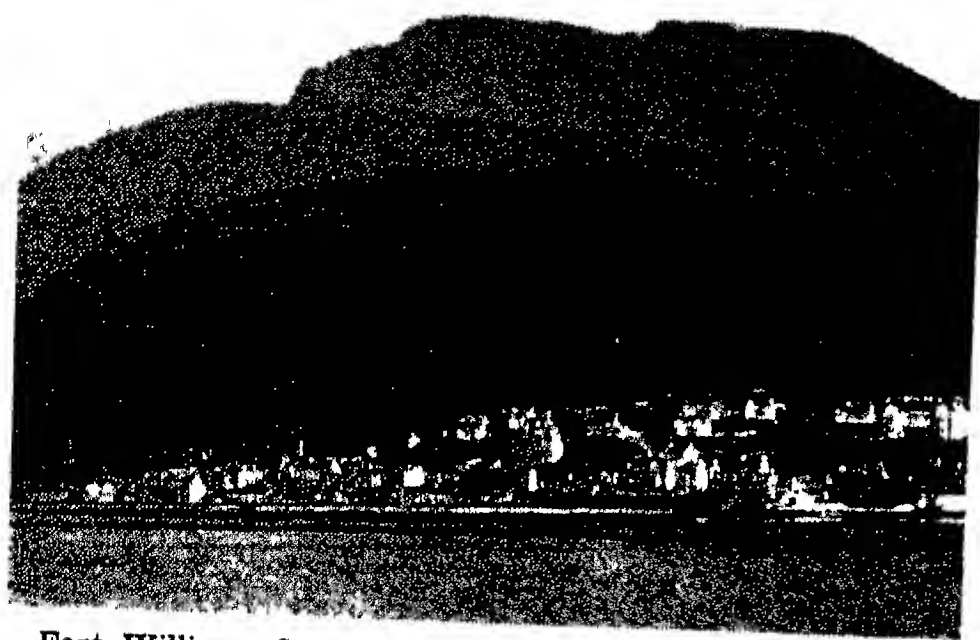
Fortune-telling. Revelation by non-rational processes of what is to befall a person in the future. As one of the principal aims of divination it is traceable from its first recorded manifestations in ancient Babylonia into early China and India. Thence it was brought across medieval Europe by the gipsies, who are recorded by Pepys as having practised the art at Lambeth under society patronage in 1689. As a modern superstitious survival it is associated with



The ruined Forum, looking north-west towards the Capitol: the three pillars with architrave in the middle distance were part of the temple of Castor and Pollux.

Top: a reconstruction of part of the Great Forum in imperial times, with a religious procession passing the temple of Castor and Pollux. Beyond is the Basilica Julia

FORUM: CENTRE OF THE LIFE OF ANCIENT ROME



Fort William, Scotland. The town, with Ben Nevis in the background, viewed from Loch Eil

1690, successfully withstood siege by the Jacobites in 1715 and 1746; it was dismantled in 1860. Fort William is a starting-point for the ascent of Ben Nevis. It has aluminium works and distilleries. Pop. (1951) 2,674.

Fort William. A port and city of Ontario, Canada, in Thunder Bay dist. It stands at the head of Lake Superior, on the left side of the Kaministiquia river. It is 420 m. E.S.E. of Winnipeg, and is served by C.P.R. and C.N.R. It has a street rly. which goes to Port Arthur, 3 m. Steamers ply from here to the ports on the Great Lakes and the St. Lawrence, and there are immense elevators to handle grain brought from the W. In addition to its shipping, for which there is 28 m. of deep-water frontage, the city has flour mills, iron foundries, and other industries. It was founded in 1801 as a Hudson Bay trading post. Pop. (1956) 39,464.

Fort Wiltshire. Old military and trading station of Cape Province, Union of South Africa. Built in 1820, it lies on the W. bank of the Keiskama river a few miles from the coast. The station has long been abandoned and is overgrown with bush.

Fort Worth. A city of Texas, U.S.A., the co. seat of Tarrant co. On Trinity river, at the confluence of its Clear and West Forks, it is 30 m. W. of Dallas, has an airport, and is served by several rlys. The chief rly. centre of the S.W. and a port of entry, it is also the centre of the oilfield and cotton growing region of West Texas, the only primary grain market in the S., and a big livestock market and meat packing centre. Products include flour, ranch and oilfield equipment, cotton goods, and cement. A bomber assembly plant was established here in 1941, during the Second Great War. The city, incorporated 1873, is on the

site of a military camp established 1849. Pop. (1950) 278,778.

Forty-Five, THE. Name given by the Scots to the rising that took place in Scotland in 1745. (Charles Edward, the Young Pretender, landed and led an army into England, marching as far south as Derby, Dec. 6.

The Scots then withdrew and were totally defeated at Culloden, April 16 (27), 1746. This was the last attempt of the Stuarts to regain the throne. See Fifteen, The.

Forty-niners. Popular name given to the adventurers who migrated to California, U.S.A., from all parts of the world following the discovery of gold there in 1848. The pop. of the state had increased by 100,000 by the end of 1849, and the flood of immigrants continued for another two years.

Forty-ninth Parallel. Line of N. lat., fixed as the boundary between Canada and the U.S.A. from the Lake of the Woods to the Rocky Mts. by a convention of 1818. It was extended to the Strait of Georgia by the Ashburton treaty, 1842, a total distance of 1,250 m. It is without defences.

Forum. Among the ancient Romans, any open space used for public business. More particularly the term was applied to the open space in Rome, an irregular oblong in shape, lying between the Palatine and Capitoline hills, called the Forum Romanum. Here the assembly of the people met; here magistrates and others addressed them from the tribunal or *rostra*. Adjoining were the Curia or senate house, the Basilica Julia and Basilica Aemilia, the temples of Julius and Vesta. Along one side the Sacra Via led to the Capitol (*q.v.*).

With the growth of the city other *fora* were added: the Forum Julium by Julius Caesar, the Forum Augustum, and the Forum Pacis, where Vespasian erected a temple of Peace containing spoils from the temple of Jerusalem. The Forum Trajani, laid out by the emperor Trajan, surpassed all others in size and splendour. Its most conspicuous feature was the column of Trajan, erected by the emperor in commemoration of his victories. It also contained a

large public library (see illustrations in page 3487).

Every town in the Roman Empire had a forum, its civic centre and market place.

Forum Appii (forum of Appius). Ancient town of Latium, on the Appian Way, probably founded by Appius (Claudius) when he built the road, 312 B.C. It stood in the Pontine (Pomptine) marshes, 40 m. S.E. of Rome, at the head of a canal going to Terracina, along which barges were towed by mules (Horace, *Sat.* I. v.). S. Paul passed through the town on his way to Rome (Acts 28, v. 15).

Foscari, FRANCESCO (1373-1457). Doge of Venice. After holding various offices in the republic he was elected doge in 1423.



Francesco Foscari, Doge of Venice After Gentile Bellini

Ambitious to extend Venetian power, he took an active part in the politics of the mainland, entering a league against the Visconti of Milan in 1426, thereby acquiring Bergamo, Brescia, and

Cremona. In 1441 Velaggio, Peschiera, and Lonato were added to the Venetian territories. The misdeeds of his son, Giacomo, brought about the doge's deposition, Oct. 24, 1457, and he died Nov. 1. Byron's tragedy, *The Two Foscari*, published in 1821, is founded on the lives of Francesco and his son.

Foscolo, Ugo (1778-1827). Italian poet, romancer, and patriot. Born at Zakynthos, Jan. 26, 1778, of Venetian and Greek descent, and christened Niccolò, he changed his first name to Ugo. His story, *Lettere di Jacopo Ortis*, 1708, reflects the melancholy of the romantic period, and his best known poem, *I Sepolcri*, 1807, was inspired by the reverence due to the tomb and the immortality of the memories of the great. Foscolo served for a time in the French army, but, disillusioned as to Napoleon's intentions, fled to England when the Austrians took Milan. He died at Turnham Green, Oct. 10, 1827, and was buried at Chiswick; his remains were removed to Florence in 1871. Consult *Life*, E. R. Vincent, 1953.



Ugo Foscolo, Italian poet

